Appendix L – CCS#1 Completion Report

CCS Well#1 Completion Report Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Mark Burau, Decatur Corn Plant Manager
Name & Official Title

217-424-5750
Phone Number

Mark Burau
Signature

May 5, 2010
Date Signed

Archer Daniels Midland Company

UIC Permit No. UIC-012-ADM
Illinois Environmental Protection Agency
Bureau of Land
Class I – Non-Hazardous Permit

UIC Form 4h, CCS Well #1 Completion Report
Revised May 05, 2010

Geological Sequestration in the Illinois Basin

Location in Application

Appendices

Appendix VIII. Schematics of injection wellbore, wellhead, and bottom hole completion assembly

Appendix IX. Operational Drilling Log

Appendix X. Records of Tests and Logs During and After Drilling (see file boxes, not in 3-ring binder)

Appendix XI. Casing and Centralizer Tally Sheets

Appendix XIII.

A. Revised UIC Form 4a

B. Revised UIC Form 4d

C. Revised UIC Form 4g

D. Copy of D.N.R. Completion Report Form

NOTE: Appendices have been numbered to correspond to the specific section of the Completion Report Form 4h with which they are associated. Not all sections are accompanied by appendices.

List of Abbreviations

ADM, Archer Daniels Midland
Aka, also known as
Bbls, barrels
BHA, bottom hole assembly
BHCT, bottom hole circulating temperature
BHST, bottom hole static temperature
BOD, basis of design
BOP, blow out preventer
B-T gauge, Bourdon-tube gauge
BTU, British thermal unit
CCS, carbon capture and sequestration
Cf, cubic feet
Cf/sk, cubic feet per sack
CFR, Code of Federal Regulations
Cm, centimeter(s)
CO_2, carbon dioxide
Csg, casing
D&CWOP, Drill and complete well on paper
Eg, for example
EMR, electronic memory recorder
EOR, enhanced oil recovery
Etc, etcetera
F, farenheit
FEED, front end engineering design
FOT, fall-off test
Ft., foot or feet
Ft/h, feet per hour
Ft/min, feet per minute
Gal/sk, gallons per sack
GR, gamma ray
HP, high pressure
Hr, hour
ID, inside diameter
IEPA, Illinois Environmental Protection Agency
ISGS, Illinois State Geological Survey
KCl, potassium chloride
L (l), liter(s)
Lb (lbs), pound (pounds)
Lb/ft, pounds per foot
Lb/sk, pounds per sack
M (m), meter(s)
M/h, meters per hour
MASIP, maximum allowable surface injection pressure
MDT, Modular Dynamics Tester* (mark of Schlumberger)
MeV, milli electronvolts

Mg/L, milligrams per liter
MGSC, Midwest Geologic Sequestration Consortium
MI, move in
MO, move out
MVA, monitoring, verification, and accounting
NaCL, sodium chloride
N/A, not applicable
NPDES, National Pollution Discharge Elimination System
NRC, Nuclear Regulatory Commission
OD, outside diameter
P&A, plugging and abandonment
PBTD, Plug back total depth
POOH, pull out of hole
Ppg, pounds per gallon
Psi, pounds per square inch
Psi/ft, pounds per square inch per foot
PV, plastic viscosity
QA, quality assurance
QA Zone, quality assurance zone
QHSE, quality, health, safety, and environment
Qty, quantity
RD, rig down
RU, rig up
RST, Reservoir Saturation Tool* (mark of Schlumberger)
S, seconds
SACROC, Scurry Area Canyon Reef Operators Committee
Sk, sack
SIP, surface injection pressure
SP, spontaneous potential
SRPG, surface-readout pressure gauge
SRTs, step rate tests
Sxs, sacks
TBD, to be determined
Tbg, tubing
TD, total depth
TDS, total dissolved solids
TIH, trip in hole
TOH, trip out of hole
UIC, underground injection control
US DOE, United States Department of Energy
USEPA, United States Environmental Protection Agency
USDW, underground source of drinking water
WFL, water flow log
WOC, wait on cement

DRAFT UIC PERMIT FORMS

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
UNDERGROUND INJECTION CONTROL PERMIT APPLICATION

FORM 4h - WELL COMPLETION REPORT

USEPA ID NUMBER: ILD984791459
IEPA ID NUMBER: 1150155136
WELL NUMBER: CCS #1

I. Type of Permit

Individual: ____
- Emergency ____
- New ____
- Renewal ____
- Permit Number ____

Area: Completion Report
- Number of well CCS #1
- Name of Field ____
- Emergency ____
- New ____
- Renewal ____
- Permit Number UIC-012-ADM

Location in Application

II. Location, see instructions

A. Township-Range-Section:

CCS Well #1 is located 438 feet South and 1332 feet East in the Northwest quadrant of Section 5 of Township 16 North and Range 3 East.

B. Latitude/Longitude:

The latitude and longitude coordinates of the well in degrees-minutes-seconds are 39° 52' 36.9402" N and 88° 53' 35.721" W.

C. Closest Municipality

The closest municipality to the well is Decatur, Macon County, IL.

III. Surface Elevation

Surface elevation of the well is 674 feet (205.4 meters) above Mean Sea Level.

IV. Well Depth

The well was drilled to a total measured depth of 7236 feet (2205.5 meters).

V. Static Water Level

The static water level in the well is 430 feet (131 meters) above Mean Sea Level

VI. Demonstrated Fracturing Pressure

The fracture pressure was demonstrated to be 5024 psig at a measured depth of 7025 feet via a step-rate injection test.

VII. Injection Well Completion

The injection well is fully-cased and perforated in the intervals 6982' – 7012' and 7025' – 7050' (wireline reference measured depth in feet) with 6 shots per foot and a shot phasing of 60 degrees.

VIII. Well schematic or other appropriate drawing of surface and subsurface construction details

Please see the injection wellbore, wellhead, and bottom hole completion assembly schematics included in Appendix VIII with this report.

IX. Well Design and Construction

Please see Appendix IX for an operational drilling log based which summarizes the rig performance throughout the drilling of the well.

A. Well hole diameters and corresponding depth intervals

The well was drilled in three stages with the following depth intervals and wellbore diameters:

<u>Surface Hole:</u> 0 – 355 feet, 26-inch diameter

<u>Intermediate Hole:</u> 355 – 5339 feet, 17.5-inch diameter

<u>Final Hole:</u> 5339 – 7236 feet, 12.25-inch diameter

B. Annulus Protection System

For additional details on the Annulus Protection System, please see the Major Permit Modification first submitted on October 30, 2009.

1. *Annular space, ID and OD (inches)*

   The annular spaces between the wellbore tubulars are detailed below and reflect the various casing/tubing sizes that were used in the wellbore design.

   <u>Surface-Intermediate (0 – 355 feet):</u> 13.375 / 19.124

   <u>Intermediate-Final #1 (3630 – 5339 feet):</u> 9.625 / 12.415

   <u>Intermediate-Final #2 (0 – 3630 feet):</u> 9.625 / 12.515

   <u>Final-Tubing #1 (5285 – 6363 feet):</u> 4.5 / 8.681

   <u>Final-Tubing #2 (0 – 5285 feet):</u> 4.5 / 8.835

2. *Type of annular fluid(s)*

   The fluids occupying the annular spaces between the wellbore tubulars are described below.

   <u>Surface-Intermediate</u>: fully cemented (see cement details in section XI.C)

   <u>Intermediate-Final #1 & #2</u>: fully cemented (see cement details in section XI.C)

   <u>Final-Tubing #1 & #2</u>: 9.4 lb/gal sodium-chloride brine with corrosion inhibitor and oxygen scavenger additives

3. *Specific gravity of annular fluid*

   The fluid occupying the annulus space between the final casing string and the injection tubing has a specific gravity of 1.127. Other annular spaces are filled with solid cement.

4. *Coefficient of annular fluid*

   The fluid occupying the annulus space between the final casing string and the injection tubing has a hydrostatic coefficient of 0.488 psi/ft.

5. *Packer(s)*

   a. *Setting depth*

      The top of the packer is set at a wireline-referenced depth of 6363.7 feet (1939.6 meters) with the center of the sealing elements at 6365 feet (1940 meters).

b. *Type*

The packer used in the completion assembly is a seal bore, retrievable production packer.

c. *Name and model*

The packer is a Schlumberger brand Quantum Max Type III Service Tool, Q-Max 13 Chrome designed for 9.625-inch outer diameter casing with linear weights ranging from 47 – 53 lb/ft.

6. *Description of fluid spotting frequency, type and quantity*

Before installing the lower portion of the injection completion (the packer), the wellbore was filled with approximately 500 barrels of 9.4 lb/gal sodium-chloride brine with corrosion inhibitor and oxygen scavenger additives. This fluid remained in the well as the upper completion (tubing, seal-bore assembly, sensors, etc.) was deployed and latched into the polished bore receptacle of the packer body. This is also the fluid that currently resides in the well and tubing-casing annular space.

7. *Information on well driller used for construction of this well*

The well was drilled with a rotary-table drilling rig with a water-based circulating mud system. Contact information for the drilling company is listed below.

Les Wilson Inc.
215 Industrial Ave.
Carmi, IL 62821
(618) 382-4666
Contact Person: Bob Wilson

X. *Tests and Logs*

A variety of wireline logs and tests were conducted during each stage of drilling and completing the well; the types of logs and tests run are listed below with detailed information included in the file box.

A. *During Drilling*

Intermediate Hole:

- Wireline Logs: (Logs included in File Box)
    - Compensated Neutron Porosity

- Photoelectric Factor & Bulk Density
- Resistivity
- Micro-Resistivity Imaging (“fracture finder”)
- Sonic
- Elemental Capture Spectroscopy
- Natural Gamma Ray Spectroscopy
- Magnetic Resonance
- Rotary Sidewall Cores

- Drill Stem Test: (Results included in File Box)

Final Hole:

- Wireline Logs: (Logs included in File Box)
  - Compensated Neutron Porosity
  - Photoelectric Factor & Bulk Density
  - Resistivity
  - Micro-Resistivity Imaging (“fracture finder”)
  - Sonic
  - Elemental Capture Spectroscopy
  - Natural Gamma Ray Spectroscopy
  - Magnetic Resonance
  - Rotary Sidewall Cores (Description of test procedures included in File Box Appendix X.A)
  - Formation Pressure Measurements & Fluid Samples
  - ‘Mini’ Fracture Pressure Measurement
  - Zero-offset Vertical Seismic Profile

- Whole Cores: (Description of test procedures included in File Box)
  - Core #1: 5474’ – 5504’
  - Core #2: 6404’ – 6434’
  - Core #3: 6750’ – 6780’

B. During and after casing installation

Surface Hole: (Logs included in File Box)

- Wireline Logs:
  - Variable Density Cement Bond Log

Intermediate Hole: (Logs included in File Box)

- Wireline Logs:
  - Ultrasonic Cement Imaging

Final Hole:

- Wireline Logs: (Logs included in File Box)

- Ultrasonic Cement Imaging
- Variable Density Cement Bond Log
- Pressure/Temperature Log
- Thermal Neutron Decay (Formation Sigma) Log
- Multi-finger Casing Caliper Log
- Casing Collar and Perforating Record Logs
- Injection Full Bore Spinner Logs

- Injectivity Testing: (Results included in File Box)
  - Step-rate Test
  - Pressure Fall-off Tests

C. *Demonstrate mechanical integrity prior to operation*

A mechanical integrity test of the tubing-casing annular space was conducted and recorded on April 27, 2010. Results are included in the file box.

D. *Copies of logs and tests listed above*

Please see file boxes accompanying completion report for copies of logs and test results.

E. *Description of well stimulation*

The injection interval was subjected to a small-scale acid injection delivered in two distinct pumping stages following the addition of perforations. Each acid injection was designed with the primary intention of reducing near-wellbore drilling or 'skin' damage. The chronology of these injections is as follows:

25-Sep-2009: The interval perforated from 7025' to 7050' was acidized with 1,500 gallons of 15% HCl acid and displaced into the formation with 123 barrels of freshwater with a potassium chloride substitute additive.

30-Sep-2009: The intervals perforated from 6,982' to 7,012' and 7025' to 7050' were acidized with 3,000 gallons of 15% HCl acid. The acid was pumped in four 750-gallon stages with 500 gallon spacers of freshwater with a potassium chloride substitute additive between each acid stage. The acid was then displaced into the formation with 121.5 barrels of freshwater with a potassium chloride substitute additive.

XI. *Well Design and Construction*

The depth intervals, outer and inner diameters, linear weight, grade, coupling type and coupling outer diameters, and thermal conductivity of the various strings of casing and tubing installed in the well are summarized below with appropriate units indicated. Please see Appendix XI for casing tally sheets and locations of casing centralizers.

A. Casings, see instructions

1. Conductive casing

N/A

2. Surface casing

Top Depth (feet): 0
Bottom Depth (feet): 355
O.D. (inch): 20
I.D. (inch): 19.124
Weight (lbs/ft): 94.00
Grade: H-40
Coupling Type: 8-round, STC
Coupling O.D. (inch): 21.00
Thermal Conductivity (BTU/ft-hr-°F): 29.02

3. Intermediate casing(s)

Top Section:
Top Depth (feet): 0
Bottom Depth (feet): 3630
O.D. (inch): 13.375
I.D. (inch): 12.515
Weight (lbs/ft): 59.50
Grade: J-55
Coupling Type: Buttress
Coupling O.D. (inch): 14.375
Thermal Conductivity (BTU/ft-hr-°F): 29.02

Bottom Section:
Top Depth (feet): 3630
Bottom Depth (feet): 5339
O.D. (inch): 13.375
I.D. (inch): 12.415
Weight (lbs/ft): 66.17
Grade: J-55
Coupling Type: Buttress
Coupling O.D. (inch): 14.375
Thermal Conductivity (BTU/ft-hr-°F): 29.02

4. Long string casing

Top Section:
Top Depth (feet): 0
Bottom Depth (feet): 5272
O.D. (inch): 9.625

I.D. (inch): 8.835
Weight (lbs/ft): 38.97
Grade: N-80
Coupling Type: 8-round, LTC
Coupling O.D. (inch): 10.625
Thermal Conductivity (BTU/ft-hr-°F): 31

Bottom Section:
Top Depth (feet): 5272
Bottom Depth (feet): 7219
O.D. (inch): 9.625
I.D. (inch): 8.681
Weight (lbs/ft): 47.00
Grade: L-80, 13Cr80
Coupling Type: JFE BEAR
Coupling O.D. (inch): 10.485
Thermal Conductivity (BTU/ft-hr-°F): 13

5. *Other casing*

N/A

B. *Injection Tubing, see instructions*

Top Depth (feet): 0
Bottom Depth (feet): 6363
O.D. (inch): 4.5
I.D. (inch): 3.958
Weight (lbs/ft): 12.6
Grade: JFE 13Cr85
Coupling Type: JFE BEAR
Coupling O.D. (inch): 5.00
Thermal Conductivity (BTU/ft-hr-°F): 13

1. *Maximum allowable suspended weight based on joint strength*

The joint strength of the tubing and, hence, maximum allowable suspended weight is 306 Kip (1361 kN).

2. *Weight of injection tubing string (axial load) in air*

The injection tubing weighs (in air) 79539 lbs (36078 kgs).

C. *Cement, see instructions*

Details about the various cement blends used in each stage of the construction of CCS Well #1, including the depth interval, type and grade, additives, quantity, thermal conductivity, and whether or not the cement was circulated to surface, are summarized in the following sections with the appropriate units indicated.

1. *Conductive casing*

N/A

2. *Surface casing(s)*

Depth Interval (feet): 0 – 355
Type/Grade (Lead): Class A
Additives (Lead): 0.2% D-46 Anti-foam, 0.25 lb/sk flake
Quantity (Lead) (cubic yards): 58

Type/Grade (Tail): Class A
Additives (Tail): 1% $CaCl_2$, 0.2% D-46 Anti-foam, 0.25 lb/sk flake
Quantity (Tail) (cubic yards): 38.67
Circulated: Yes
Thermal Conductivity (BTU/ft-hr-°F): 0.7

3. *Intermediate casing*

A comment on the intermediate casing cement design:
The lead cement system was changed from that proposed in the permit application due to lost circulation encountered while drilling the well. Lost circulation was encountered in the Knox at a depth of approximately 4562 feet and again in the Ironton-Galesville at 5017 feet. Both zones were sealed off with cement plugs, however, there was concern that during cementing operations the plugs might fail and lost circulation would be encountered while cementing. Therefore, the cement job was completed in two stages with a stage collar run at 3715 feet. The first stage cement was changed from a Class A system to Class H cement due to better performance characteristics of Class H cement – primarily lack of a gelation tendency present in Class A. The second stage lead system was changed from a 50/50 Class A- Pozzolan with 6% bentonite and 10% salt mixed at a density of 13.3 ppg to a 65/35 Class A-Pozzolan system with 4% bentonite and 10% salt with 5 lbs/sk Kolite mixed at a density of 12.7 ppg in order to lighten the slurry, thus enabling cement to be circulated to surface. The difference in 24 hour compressive strength was small: 575 psi in 24 hours for the 65/35 system compared to 655 psi in 24 hours for the original 50/50 system. The actual job went very well with cement circulated to surface and good bonding obtained from the base of the intermediate casing to surface.

Stage 1:

Depth Interval (feet): 3715 – 5339
Type/Grade (Lead): Class H

Additives (Lead):

Additives		
Code	**Concentration**	**Function**
D081	0.040 gal/sk blend	Retarder
D047	0.020 gal/sk blend	Antifoam

Quantity (Lead) (cubic yards): 54.7
Circulated: Yes
Thermal Conductivity (BTU/ft-hr-°F): 0.71

Type/Grade (Slurry): Class H
Additives (Slurry):

Additives		
Code	**Concentration**	**Function**
D081	0.080 gal/sk blend	Retarder
D047	0.020 gal/sk blend	Antifoam

Quantity (Slurry) (cubic yards): 46.3
Circulated: No
Thermal Conductivity (BTU/ft-hr-°F): 0.75

Type/Grade (Tail): Class H
Additives (Tail):

Additives		
Code	**Concentration**	**Function**
D081	0.080 gal/sk blend	Retarder
D047	0.020 gal/sk blend	Antifoam

Quantity (Tail) (cubic yards): 45.8
Circulated: No
Thermal Conductivity (BTU/ft-hr-°F): 0.78

Stage 2:

Depth Interval (feet): 0 – 3715
Type/Grade (Lead): 35:65 (pozzolan:cement blend)
Additives (Lead):

Additives		
Code	**Concentration**	**Function**
D020	4.000 %BWOB	Extender
D044	10.000 %BWOW	Salt
D065	0.600 %BWOB	Dispersant
D167	0.200 %BWOB	Fluid loss
D046	0.200 %BWOB	Antifoam
D042	4.787 lb/sk blend	LCM/extender

Quantity (Lead) (cubic yards): 221.3
Circulated: Yes
Thermal Conductivity (BTU/ft-hr-°F): 0.47

Type/Grade (Slurry): 35:65 (pozzolan:cement blend)
Additives (Slurry):

Additives		
Code	**Concentration**	**Function**
D020	4.000 %BWOB	Extender
D044	10.000 %BWOW	Salt
D065	0.600 %BWOB	Dispersant
D167	0.200 %BWOB	Fluid loss
D046	0.200 %BWOB	Antifoam
D042	4.787 lb/sk blend	LCM/extender

Quantity (Slurry) (cubic yards): 239.2
Circulated: No
Thermal Conductivity (BTU/ft-hr-°F): 0.5

Type/Grade (Tail): Class H
Additives (Tail):

Additives		
Code	**Concentration**	**Function**
D047	0.020 gal/sk blend	Antifoam
D081	0.020 gal/sk blend	Retarder

Quantity (Tail) (cubic yards): 38.67
Circulated: No
Thermal Conductivity (BTU/ft-hr-°F): 0.72

4. *Long string casing*

Depth Interval (feet): 0 – 4170
Type/Grade (Lead): 35:65 LP3:A (pozzolan:cement blend)
Additives (Lead):

Additives		
Code	**Concentration**	**Function**
D020	6.000 %BWOB	Extender
D046	0.200 %BWOB	Antifoam
D167	0.400 %BWOB	Fluid loss

Quantity (Lead) (cubic yards): 249.5
Circulated: Yes
Thermal Conductivity (BTU/ft-hr-°F): 0.47

Depth Interval (feet): 4170 - 7219
Type/Grade (Tail): EverCRETE
Additives (Tail):

Additives		
Code	**Concentration**	**Function**
D081	0.035 gal/sk blend	Retarder
D168	0.170 gal/sk blend	Fluid loss
D206	0.030 gal/sk blend	Antifoam
D080	0.050 gal/sk blend	Dispersant

Quantity (Tail) (cubic yards): 112.1
Circulated: No
Thermal Conductivity (BTU/ft-hr-°F): 0.72

5. *Other casing*

N/A

XII. *Surface Facilities*

For additional details on the surface facilities, please see the Major Permit Modification first submitted on October 30, 2009.

A. *Filters(s)*

N/A

B. *Injection pump(s)*

The table below summarizes the specifications of the various injection pumps in the surface compression system. Please see annotations on the Process Control Strategy Diagram accompanying the Major Permit Modification first submitted on October 30, 2009 for the location of pumps with respect to the entire compression/dehydration facility.

TYPE	NAME	MODEL NUMBER	CAPACITY
Multistage Centrifugal Blower	BL-101	HSI 18604	21 MMSCFD
Reciprocating Compressor	VC-201 & VC-301	Ariel JGC6-4, 3250 HP	10.85 MMSCFD (each)
Multistage Centrifugal Pump	ESP PUMP	Wood Group SJ0270	21 MMSCFD (282.9 US GPM)

XIII. *Hydrogeologic Information*

A. *Revised UIC Form 4a*

Please see Revised UIC Form 4a included as Appendix XIII.A.

B. *Revised UIC Form 4d using actual data on injection formation*

Please see Revised UIC Form 4d included as Appendix XIII.B.

C. *Revised UIC Form 4g*

Please see Revised UIC Form 4g included as Appendix XIII.C.

D. *Copy of well completion report submitted to the Department of Natural Resources (Formerly Mines and Minerals)*

Please see attached copy of well completion report submitted to the DNR included as Appendix XIII.D.

E. *Copy of any plugging affidavits on injection well filed with Department of Natural Resources*

N/A

XIV. Injection Fluid Compatibility

The following information is presented as an update to that which was previously submitted with the original permit application in Chapter 9: UIC Form 4f, Section V. In the cases where no new information is presented, reference is made to the language in the original permit application.

A. *Compatibility with injection zones fluid*

No compatibility problems are anticipated in the injection zone. Geochemical modeling was used to predict the effects of injecting supercritical CO_2 into a model Mt. Simon sandstone (Berger et al., 2009). Based on chemical and mineralogical data from the Manlove Gas Storage Field in Illinois, the geochemical modeling software package, Geochemist's Workbench (Bethke, 2006), was used to simulate geochemical reactions. As expected, the injected CO_2 decreased the pH of the formation brine to about pH 4.5. As the reaction was allowed to progress, the pH of the formation brine increased to pH 5.4.

B. *Compatibility with minerals in the injection zone*

In the geochemical simulations mentioned in above, Berger et al. (2009), it was predicted that illite and glauconite dissolved initially. As the reaction was allowed to proceed, kaolinite and smectite were predicted to precipitate. It was predicted that the volume of pore space would not be significantly altered (Berger et al., 2009). Therefore, no compatibility problems, such as a major reduction in injection-formation permeability resulting from chemical precipitates, are expected.

C. *Compatibility with minerals in confining zone*

In the geochemical simulations mentioned above, Geochemist's Workbench predicted that as the CO_2 reacts with the Eau Claire formation, illite and smectite would initially dissolve, but that the dissolved CO_2 could be precipitated as carbonates (Berger et al., 2009). This dissolution and precipitation process is not expected to affect the caprock integrity.

D. Compatibility with injection well components

1. Injection tubing

As the CO_2 will be dehydrated to less than 30 lb/MMSCF or 630 ppmv, the expected reactivity with the tubing will be negligible. Nevertheless, the injection tubing is composed of chrome steel (13 Cr) and is specifically engineered to function in environments with high concentrations of CO_2. This reflects the design specifications approved under the UIC Permit No. UIC-012-ADM.

2. Long string casing

As per the design specifications approved under the UIC Permit No. UIC-012-ADM, the long string casing installed from total depth of the well past the base of the confining layer (to a depth of 5285') is composed of chrome steel (13 CR) and is specifically engineered to function in environments with high concentrations of CO_2. The long string casing in the remainder of the well (5285' to surface) is carbon steel. This section of casing, however, will remain isolated from the injected CO_2 due to the tubing-annulus protection system and the protective cement sheath in which it encased. Reactivity between the injected CO_2 and the long string casing is expected to be negligible.

3. Cement

As specified under UIC Permit No. UIC-012-ADM, the long string casing is encased from total depth to approximately 4170 feet (or approximately 1170 feet into the intermediate casing string) in Schlumberger's proprietary blend of CO_2-resistant cement, EverCRETE. Technical descriptions of the cement properties can be found in the original permit application (Chapter 9: UIC Form 4f, Section V, pages 135-139) and accompanying appendices. Reactivity between the injected CO_2 and the cement is expected to be negligible.

4. Annular fluid

The annular fluid between the injection tubing and the long string casing is a 9.4 lb/gal sodium chloride brine with corrosion inhibitor and oxygen scavenger additives that are compatible with the injected CO2 and will minimize corrosion to the tubing and casing. Reactivity between the injected CO_2 and the annular fluid is expected to be negligible.

5. Packer(s)

The injection packer installed is a Schlumberger Quantum Max Type III Seal-bore Assembly packer composed of chrome steel (13 Cr). The sealing elements of the packer and seal-bore assembly are comprised of Nitrile rubber which is designed to be durable in environments with high CO_2 concentration. As a result, reactivity between the injected CO_2 and the injection packer is expected to be negligible.

6. Well head equipment

Components of the wellhead equipment expected to be in contact with the injected CO_2 are constructed from schedule 310 and 410 stainless steel; therefore, no adverse reactions are expected between the injected CO_2 and any the wellhead components.

7. Holding tank(s) and flow lines

There will be no holding tanks for the injection fluid. Consequently, there are no CO_2 holding tank compatibility concerns.

The CO_2 is transferred from the surface compression facilities via approximately 6400 feet of 6-inch Schedule 40 carbon steel pipeline to the wellhead. The design basis for the surface facility gas dehydration unit is to reduce the water content of the CO_2 to a range of 7 to 30 lb of H_2O/MMSCF (150 to 630 ppmv H_2O). This water content range is consistent with typical U.S. CO_2 transmission pipeline water content specifications for carbon steel pipe, therefore, no corrosive reactions are anticipated.

E. Full description of compatibility of injection fluid with items A-D

In summary, there are no compatibility concerns with the injection zone, minerals in the injection zone, and minerals in the confining zone. The CO_2 is expected to have negligible to no reaction with the minerals and formation water. Any reactions that may occur are not expected to affect the containment of the CO_2 below the primary seal.

Components to the injection wellhead and wellbore have been selected to minimize and negate any reaction with the CO_2. Additional details on the corrosion monitoring plan are included the Major Permit Modification first submitted on October 30, 2009.

Sources:

Bethke, C.M.. 2006. The Geochemist's Workbench (Release 6.0) Reference Manual. RockWare, Inc., Golden CO, 240 p.

Berger, P.M., Mehnert, E., and Roy, W.R. (2009) Geochemical Modeling of Carbon Sequestration in the Mt. Simon Sandstone. Geological Society of America *Abstracts with Programs*, vol. 41, no. 4, p. 4.

XV. Monitoring Program

Details of the various process monitoring sensors and gauges are summarized below and include the location of the device, the brand and model number, the device type (electrical or mechanical), and whether or not the device is continuously recording.

A. Injection pressure gauge(s)

Surface Injection Pressure Gauge: PIT-009 (Please see Process Control Strategy Diagram in Appendix XII)
Location: Installed directly into the wellhead tree cap port.
Make / Model: ABB / 264HSVKTA1L1N2
Type: Electrical; Continuous Recording
Operating Range (psig): 0 – 4000; this exceeds maximum operating range of system by more than 20%

Downhole Injection Pressure Gauge: (Please see injection wellbore schematic in Appendix VIII)
Location: Mounted within the downhole solid gauge mandrel at a measured depth of 6325 feet as part of the tubing completion.
Make / Model: Schlumberger / NDPG-CA (P/N 500897)
Type: Electrical; Continuous Recording
Operating Range (psig): 0 – 10000; this exceeds maximum operating range of system by more than 20%

B. Casing-tubing annular pressure gauge(s)

For additional details on the Annulus Protection System, refer to the description included as Appendix IX.A.

Location: Mounted on the wellhead port open to the casing-tubing annulus.
Make / Model: Unknown at this time; compliant with ASME B 40.1 specifications
Type: Electrical (4-20 mA); Continuous Recording
Operating Range (psig): 0 – 600; this exceeds maximum operating range of system by more than 20%

C. Flow meter(s)

Location: Installed downstream of the multistage centrifugal pump (FIT006 – Please see Process Control Strategy Diagram in Appendix XII)
Make / Model: SCADASense / 4203
Type: Electrical; Continuous Recording

Operating Range (tonnes/day): 250 – 1100; this meets the maximum operating range of the system but does not exceed it by more than 20%

D. *pH recording device(s)*

N/A

E. *Temperature*

Surface Temperature Gauge: TIT-009 (Please see Process Control Strategy Diagram in Appendix XII)
Location: Installed downstream of the multistage centrifugal pump along the section of pipeline immediately upstream of the wellhead wing valve inlet and check valve.
Make / Model: INOR / Meso-HX 70MEHX1001
Type: Electrical; Continuous Recording
Operating Range (degF): -40 – 185; this exceeds maximum operating range of system by more than 20%

Downhole Temperature Gauge: (Please see injection wellbore schematic in Appendix VIII)
Location: Mounted within the downhole solid gauge mandrel at a measured depth of 6325 feet as part of the tubing completion.
Make / Model: Schlumberger / NDPG-CA (P/N 500897)
Type: Electrical; Continuous Recording
Operating Range (degF): 0 – 212; this exceeds maximum operating range of system by more than 20%

Appendix VIII – CCS Well #1 Wellbore & Wellhead Schematics

Schlumberger

Illinois Basin - Decatur Project

Prepared for : Paul Huges	Date : Nov-24-2009	Casing : 9 5/8" 40&47# N-80& CR13	Completion Type : Upper Compleation	Pressure/Temp. 3245psi BHP 135 Degree F
Field Name : Illinois Basin	Well Name : ADM CCS #1	Casing Drift ID 8.681/Drift 8.525	Rig: Wilson 28	
Prepared by : Roberto Schuldes	District/Phone # : Houma, LA / (985) 851-1074			
Production Tubing : 4 1/2" 12.6# CR13 JFE Bear				

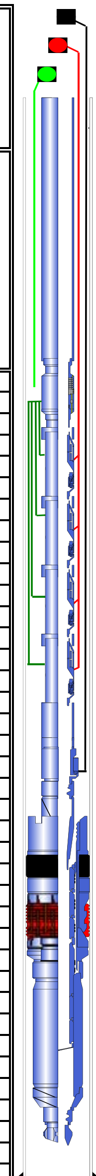
String Weight Include Block -	Rig: Ideco H-35/Pioner Rig 15
Block Weight -	Item's Actual Pipe Measured Length - 6335.32
Weight On Locator -	Packer Fluid Type and Weight - 9.4 ppg NaCl
Original RKB -	Completion Fluid Type and Weight - 9.4 ppg NaCl

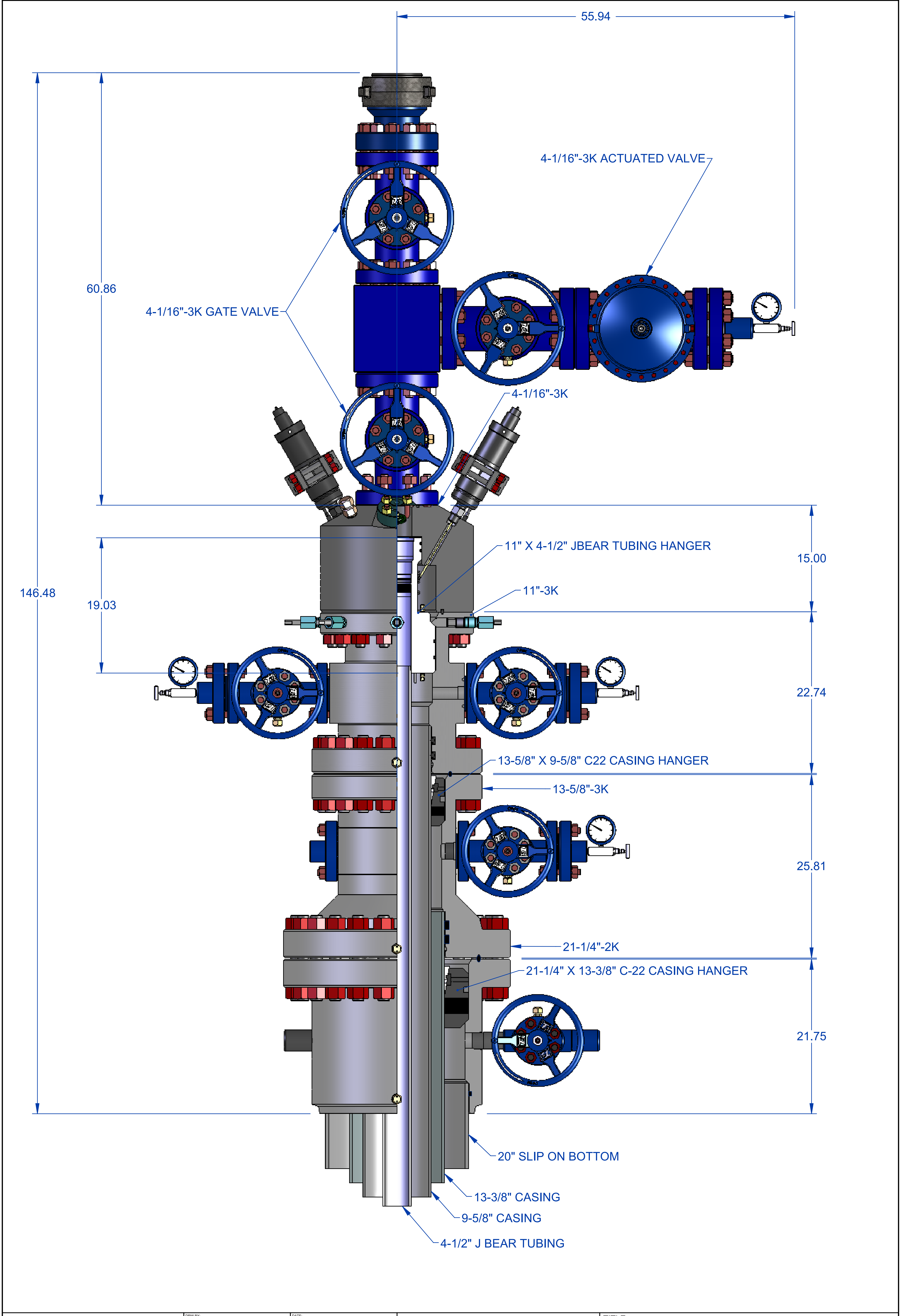
All Depths Are Wireline Depths

Production String Assembly

0.00	0.55	11.000	3.958	**Hanger PN: HTG6561, Top Thread: 4-1/2 EUE 8rd**
0.55	30.75	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joints (5.52+10.34+8.34+6.55)
31.30	4883.83	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear tubing (Adjusted by 49.07)
4915.13	10.34	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
4925.47	9.97	8.350	3.958	**Geophone #3**
4935.44	10.34	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
4945.78	786.51	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear tubing
5732.29	10.36	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
5742.65	9.97	8.350	3.958	**Geophone #2**
5752.62	10.38	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
5763.00	236.64	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear tubing
5999.64	8.34	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
6007.98	118.40	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear tubing
6126.38	10.34	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
6136.72	9.97	8.350	3.958	**Geophone #1**
6146.69	10.34	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
6157.03	157.96	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear tubing
6314.99	10.36	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
6325.35	6.01	5.712	3.879	**4 1/2, 12.60, SGM-FS, NDPG/NLOG, SINGLE, TUBING**
6331.36	10.33	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
6341.69	10.33	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
6352.02	1.36	4.500	3.813	**4 1/2" x 3.813 X-nipple JFE Bear**
6353.38	10.33	4.500	3.958	4 1/2 12.6# 13Cr JFE Bear pup joint
6363.71	2.08	7.000	3.500	**4.75" Snap latch 13Cr (4 1/2 12.6# JFE Bear)**
6365.79	9.00	4.690	3.500	4.75" Seal Unit 4.124" 13Cr SLHT pin x box ID:127088 PN:4
6374.79	0.81	4.690	3.500	X-O, 4.063-8 SA Pin x 4.124" 13Cr SLHT Box PN: 100714412
6375.60	2.51	4.724	3.750	SAGS w/ inner sleeve 13chr 4.063 8SA Box ID: 164949-01, PN:100602582/AA
6378.11				End of Assembly

Depth	Length	ID	OD	Quantum Max Packer Assembly
6363.71	6.47	4.750	8.341	9 5/8" x 4.75" (47-53.5#) Q-Max 13Cr w/HNBR ID# 250148-03
6370.18	0.83	5.443	7.013	X-O, 6.375" 6-SA Box x 6.25" 8-SA Box HOS-252940
6371.01	19.06	4.750	6.974	9 5/8" x 4.75" x 20' PBR PO# 101046
6390.07	1.14	3.431	6.950	X-O, 4" 11.6# NU 8rd Pin x 6.375" 6-SA Box HOS-252941
6391.21	10.33	3.442	4.752	4" NU 8rd 11.6# 13Cr85 Pup Joint w/ Collar
6401.54	1.54	3.313	4.744	4" x 3.313" X-Nipple C-36025-01
6403.08	10.31	3.442	4.745	4" NU 8rd 11.6# 13Cr85 Pup Joint w/ Collar
6413.39	0.71	3.672	4.780	4" NU 8rd 11.6# 13Cr85 Wireline Re-Entry Guide w/ mule shoe SO# 729775
6414.10				EOA





DRW BY: NJB	DATE:
APVD BY:	DATE:

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TITLE

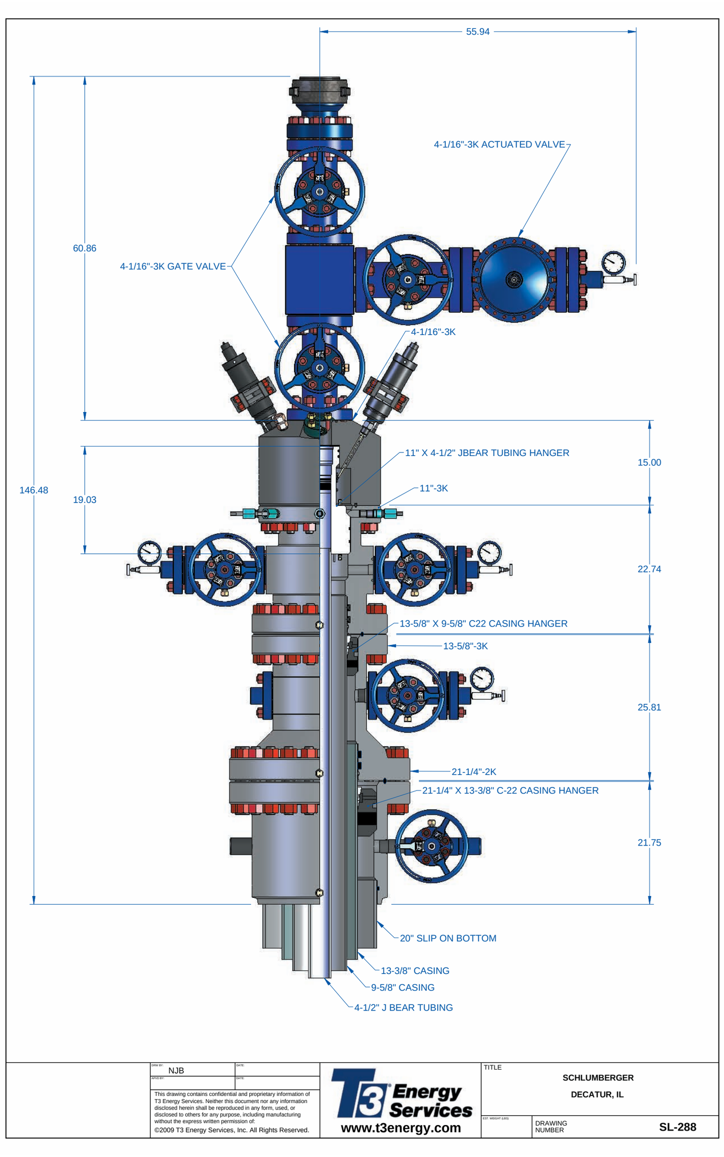
SCHLUMBERGER

DECATUR, IL

EST. WEIGHT (LBS)

DRAWING NUMBER **SL-288**

Appendix VIII - CCS# 1 Injection Wellbore Schematic



Appendix IX – CCS Well #1 Operational Drilling Log

NOTE: the following operational drilling log is a continuous record of key drilling rig performance metrics which can be used to make qualitative inferences about the various geologic properties and drilling conditions encountered in the well. The log, which includes the entirety of the drilling operation of CCS Well #1, includes such information as the weight on the drilling bit, the weight on the rig's travelling block ('Hook Load'), rate of rotation, rotational torque, mud pump output, rate of penetration, along with the driller's comments during various operational milestones or decision points and the chronology of these events.

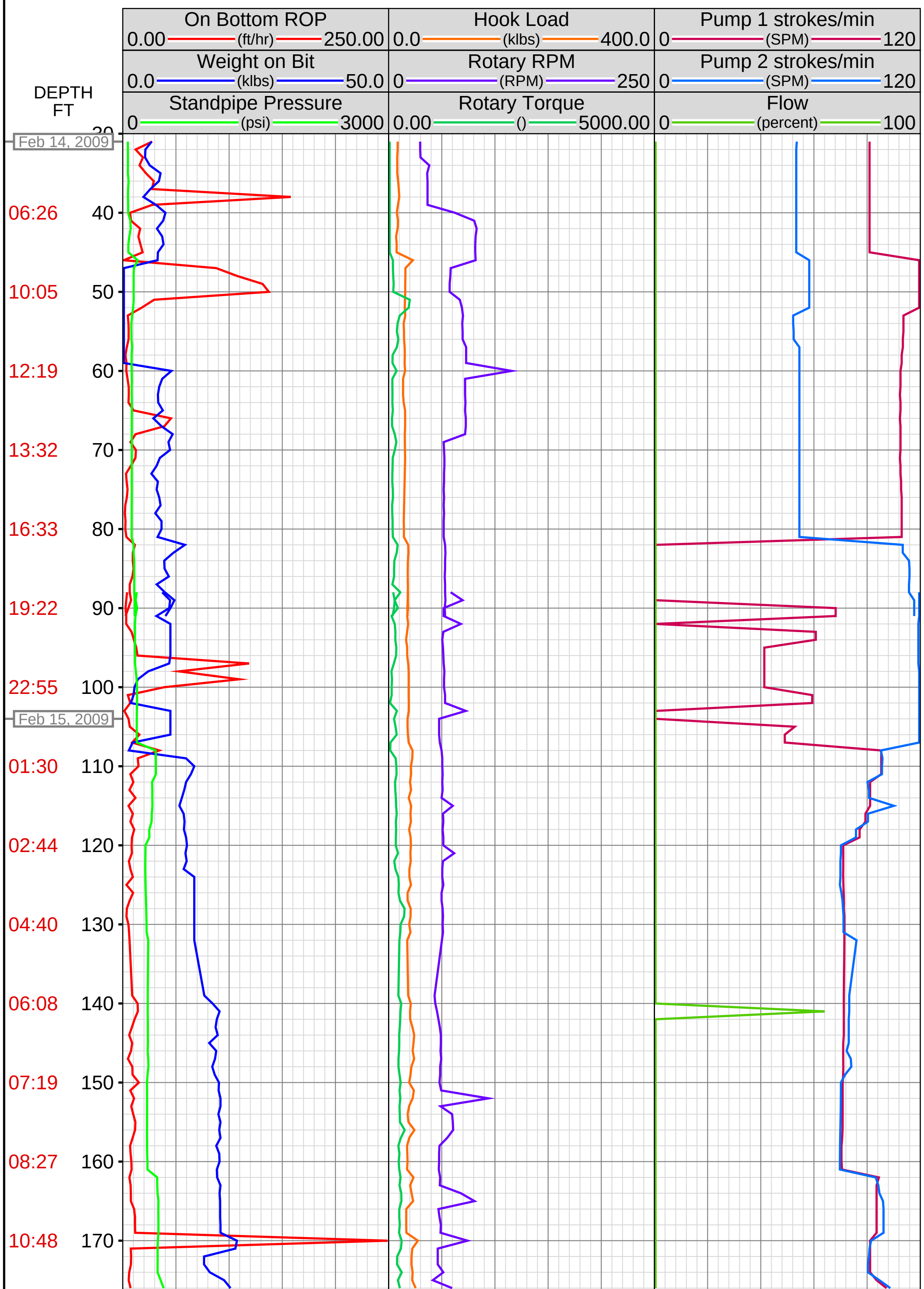
NOTE: the following operational drilling log is a continuous record of key drilling rig performance metrics which can be used to make qualitative inferences about the various geologic properties and drilling conditions encountered in the well. The log, which includes the entirety of the drilling operation of CCS Well #1, includes such information as the weight on the drilling bit, the weight on the rig's travelling block ('Hook Load'), rate of rotation, rotational torque, mud pump output, rate of penetration, along with the driller's comments during various operational milestones or decision points and the chronology of these events.

Tue Mar 16, 2010 08:33:19
Well Dossier 1607061
Ethan Chabora

DataHub EDR Log

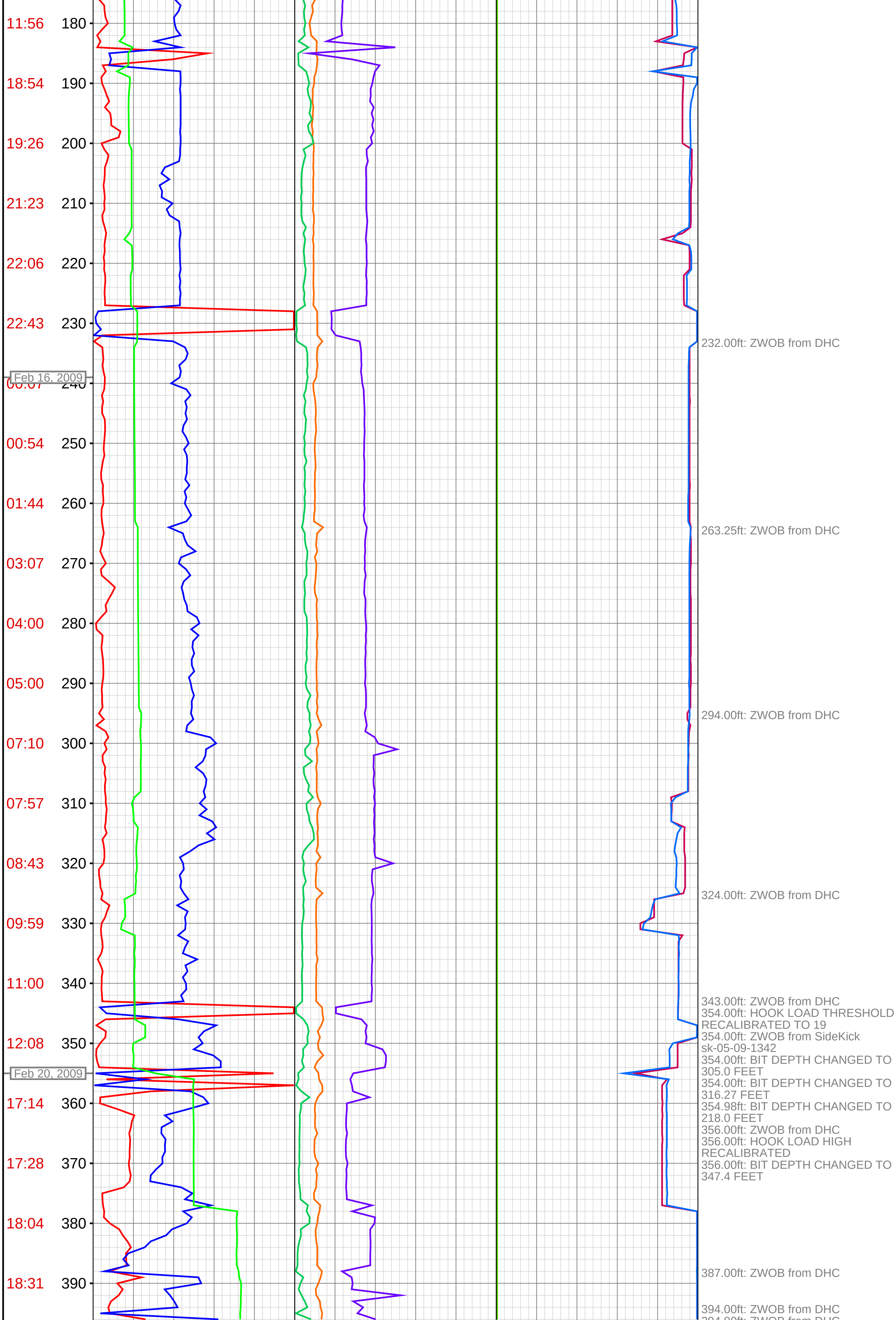
OPERATOR: ADM (Archer Daniel Midland)
WELL: ADM COMPANY CCS WELL NO 1
FIELD:
LOCATION:
COUNTRY: USA
RIG: Les-Wilson 25

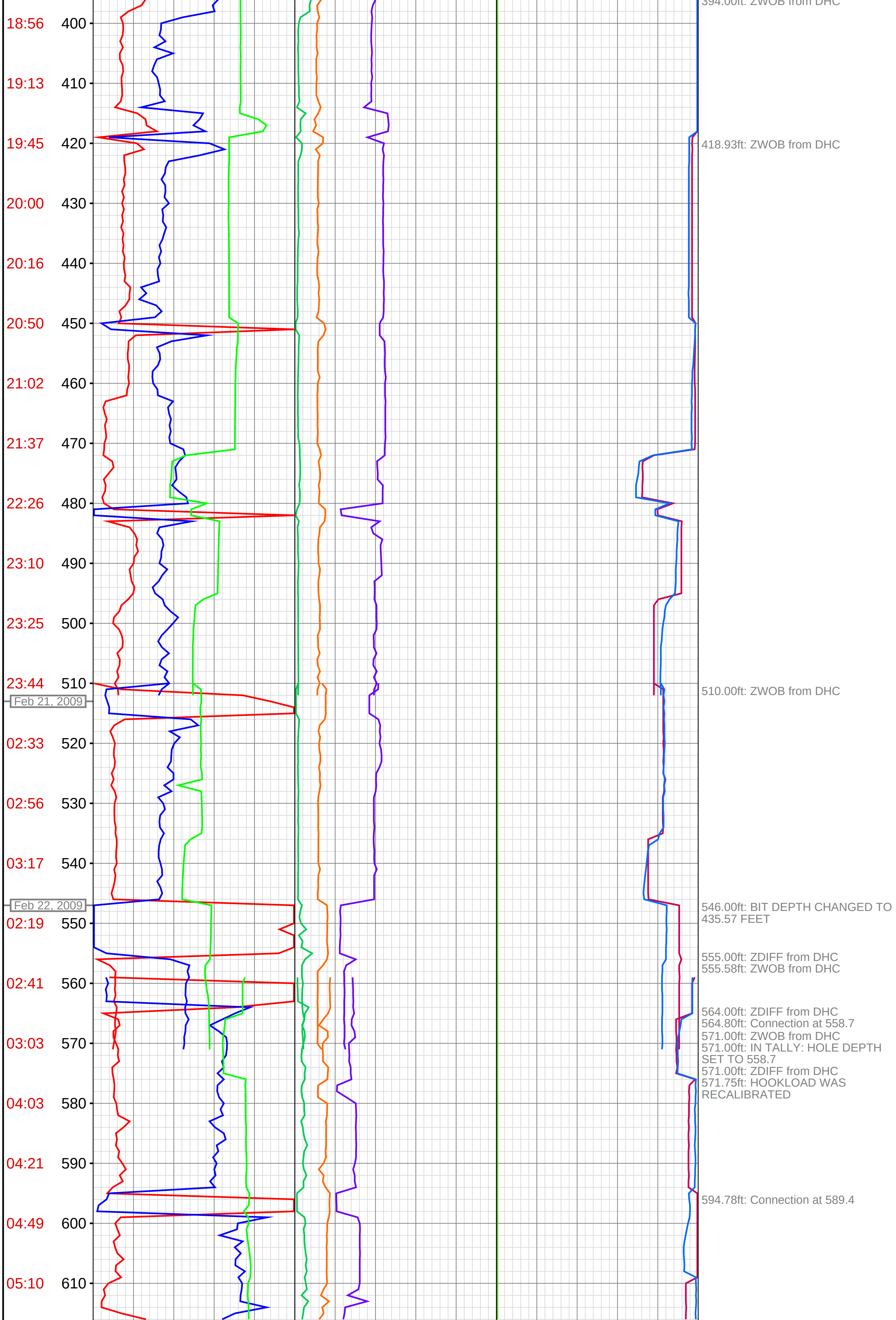
CONTRACTOR: Les Wilson Drilling
UNIQUE WELL ID:
SPUD DATE: Feb 14, 2009 05:00
RELEASE DATE: May 05, 2009 10:08



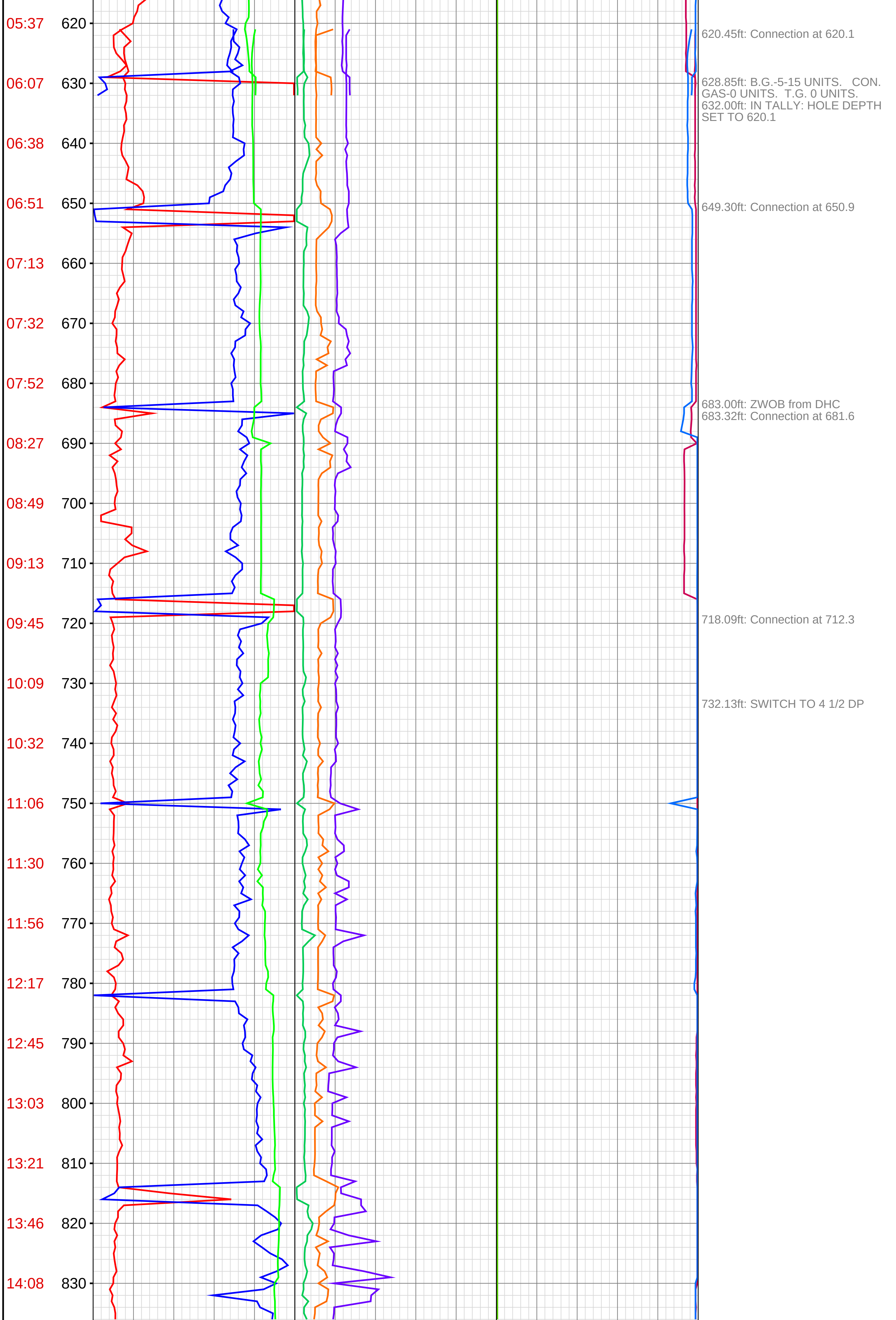
MEMOS

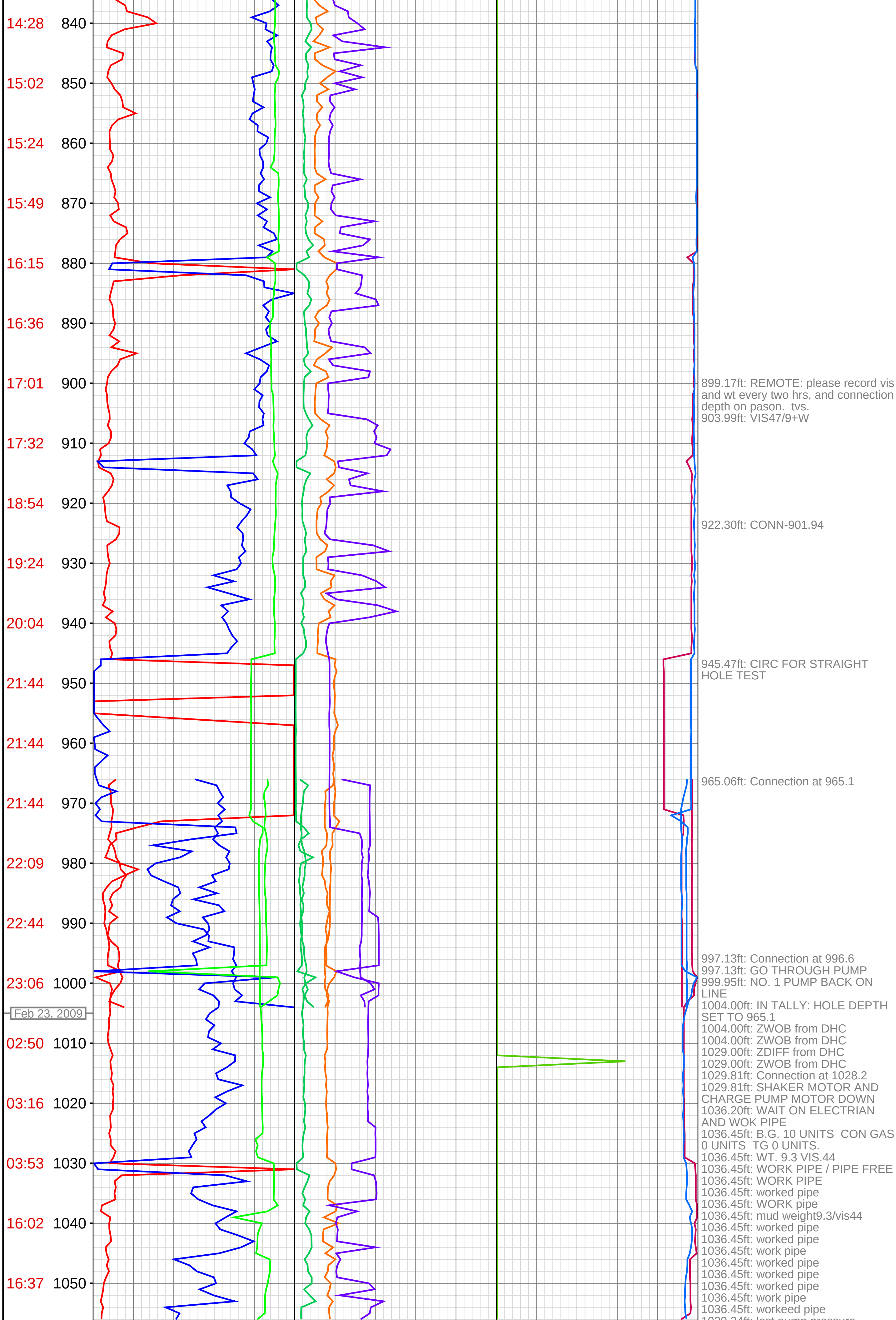
45.00ft: TORQUE LOW READING RECALIBRATED
45.00ft: TORQUE HIGH READING RECALIBRATED
45.00ft: SYSTEM-WIDE UNIT CHANGE FOR TORQUE TO FT-LBS
45.00ft: SYSTEM-WIDE UNIT CHANGE FOR TORQUE TO kFT-LBS
50.00ft: HOLE DEPTH CHANGED TO 30.0 FEET
50.00ft: SYSTEM-WIDE UNIT CHANGE FOR TORQUE TO PSI
52.00ft: HOOK LOAD THRESHOLD RECALIBRATED TO 11
52.00ft: STANDPIPE PRESSURE SENSOR CHANGED
52.82ft: STANDPIPE PRESSURE SENSOR CHANGED
56.00ft: TORQUE HIGH READING RECALIBRATED
56.14ft: TORQUE LOW READING RECALIBRATED
59.54ft: ZWOB from DHC
81.00ft: BIT DEPTH CHANGED TO 81.5 FEET
89.01ft: SURVEY
91.00ft: HOOK LOAD THRESHOLD RECALIBRATED TO 21
91.63ft: HOOKLOAD WAS RECALIBRATED
107.00ft: ZWOB from DHC
107.87ft: REMOTE: What's up?? - SM
132.00ft: ZWOB from DHC
169.00ft: ZWOB from SideKick sk-05-09-1342
169.00ft: ZWOB from DHC

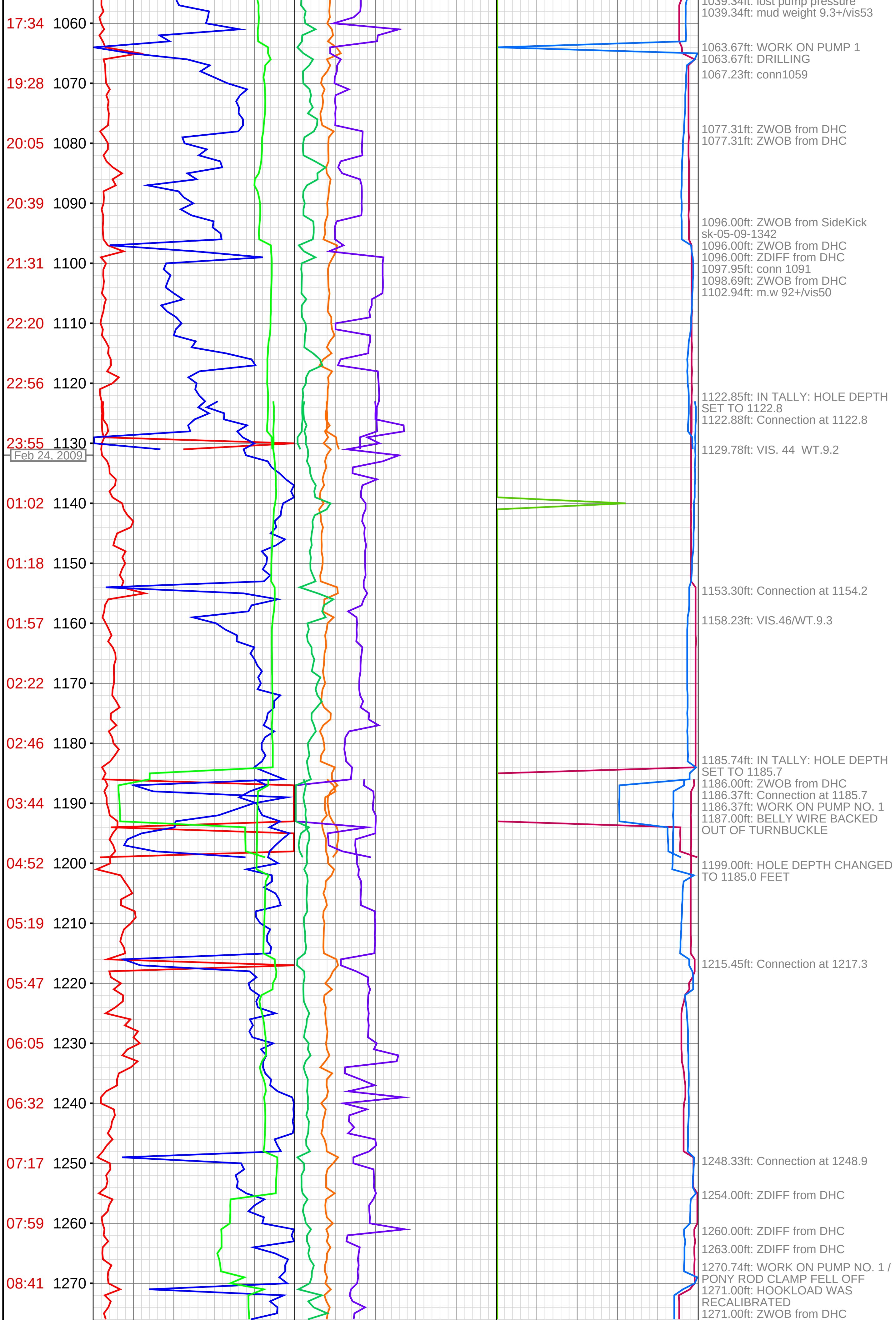

11:56 180
18:54 190
19:26 200
21:23 210
22:06 220
22:43 230
232.00ft: ZWOB from DHC
Feb 16, 2009
00:07 240
00:54 250
01:44 260
263.25ft: ZWOB from DHC
03:07 270
04:00 280
05:00 290
294.00ft: ZWOB from DHC
07:10 300
07:57 310
08:43 320
324.00ft: ZWOB from DHC
09:59 330
11:00 340
343.00ft: ZWOB from DHC
354.00ft: HOOK LOAD THRESHOLD RECALIBRATED TO 19
354.00ft: ZWOB from SideKick sk-05-09-1342
354.00ft: BIT DEPTH CHANGED TO 305.0 FEET
354.00ft: BIT DEPTH CHANGED TO 316.27 FEET
354.98ft: BIT DEPTH CHANGED TO 218.0 FEET
356.00ft: ZWOB from DHC
356.00ft: HOOK LOAD HIGH RECALIBRATED
356.00ft: BIT DEPTH CHANGED TO 347.4 FEET
12:08 350
Feb 20, 2009
17:14 360
17:28 370
18:04 380
387.00ft: ZWOB from DHC
18:31 390
394.00ft: ZWOB from DHC



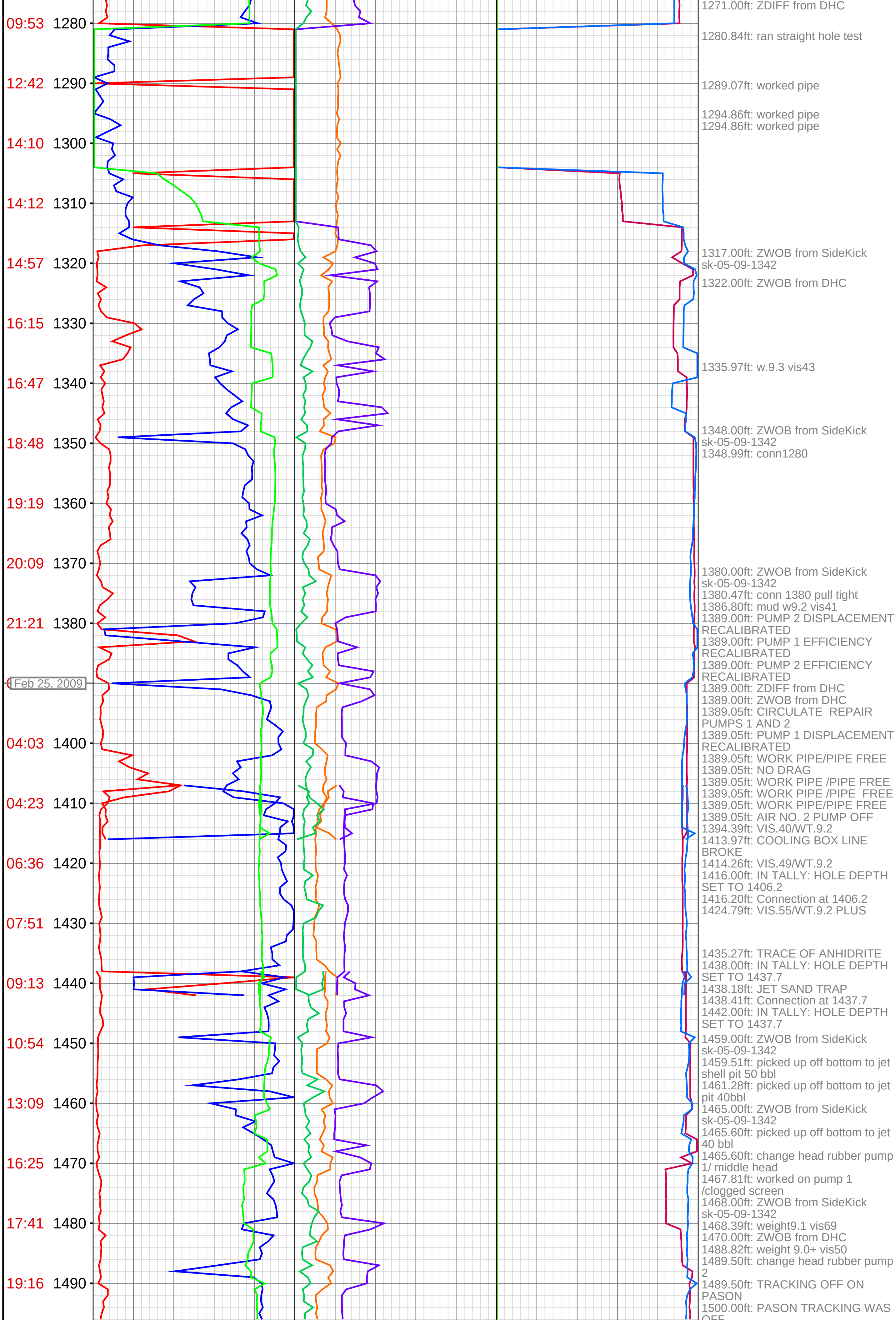
394.00ft: ZWOB from DHC
18:56 400
19:13 410
19:45 420
418.93ft: ZWOB from DHC
20:00 430
20:16 440
20:50 450
21:02 460
21:37 470
22:26 480
23:10 490
23:25 500
23:44 510
510.00ft: ZWOB from DHC
Feb 21, 2009
02:33 520
02:56 530
03:17 540
Feb 22, 2009
546.00ft: BIT DEPTH CHANGED TO 435.57 FEET
02:19 550
555.00ft: ZDIFF from DHC
555.58ft: ZWOB from DHC
02:41 560
564.00ft: ZDIFF from DHC
564.80ft: Connection at 558.7
571.00ft: ZWOB from DHC
571.00ft: IN TALLY: HOLE DEPTH SET TO 558.7
571.00ft: ZDIFF from DHC
571.75ft: HOOKLOAD WAS RECALIBRATED
03:03 570
04:03 580
04:21 590
594.78ft: Connection at 589.4
04:49 600
05:10 610

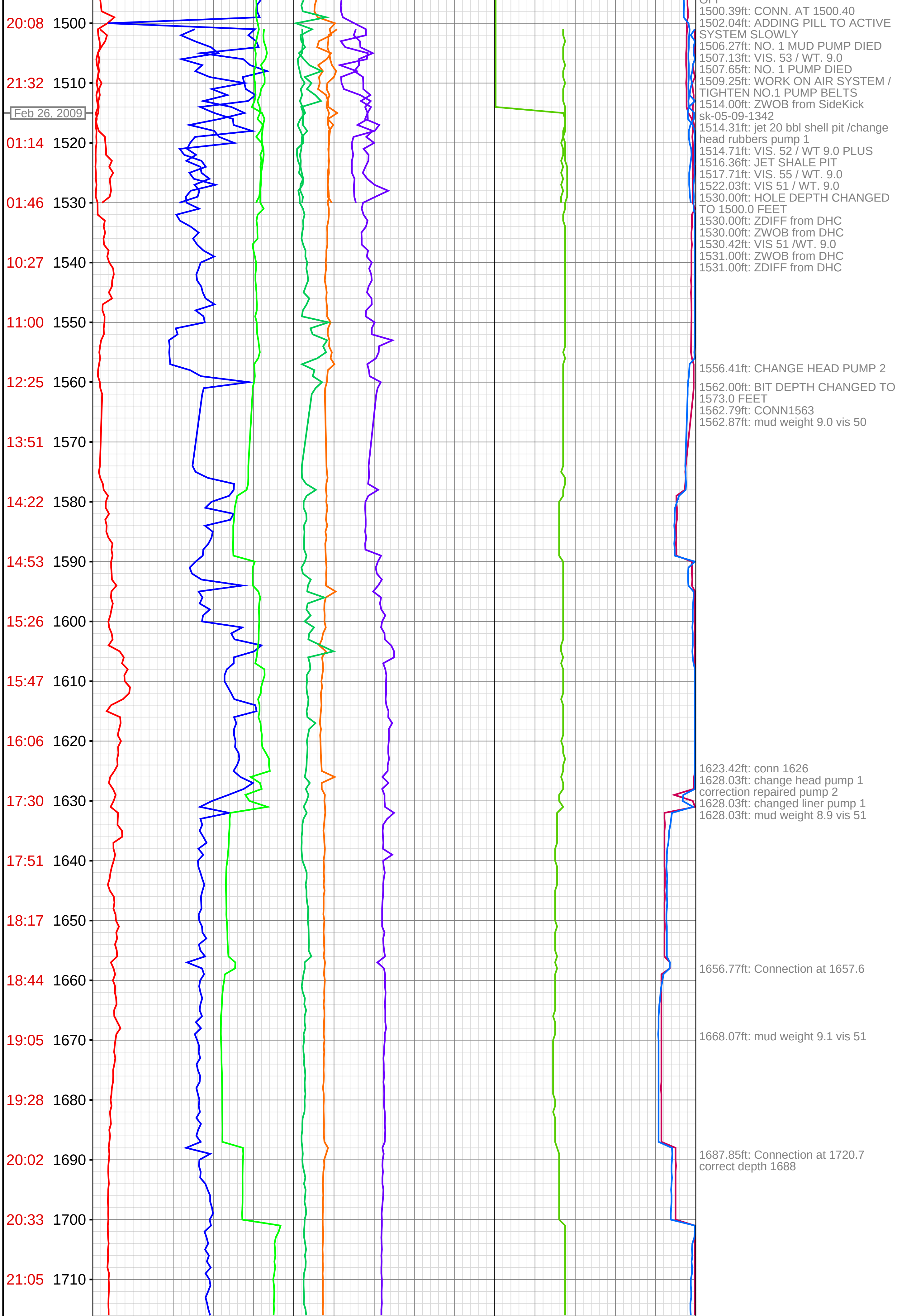

05:37 620
06:07 630
06:38 640
06:51 650
07:13 660
07:32 670
07:52 680
08:27 690
08:49 700
09:13 710
09:45 720
10:09 730
10:32 740
11:06 750
11:30 760
11:56 770
12:17 780
12:45 790
13:03 800
13:21 810
13:46 820
14:08 830
620.45ft: Connection at 620.1
628.85ft: B.G.-5-15 UNITS. CON. GAS-0 UNITS. T.G. 0 UNITS.
632.00ft: IN TALLY: HOLE DEPTH SET TO 620.1
649.30ft: Connection at 650.9
683.00ft: ZWOB from DHC
683.32ft: Connection at 681.6
718.09ft: Connection at 712.3
732.13ft: SWITCH TO 4 1/2 DP

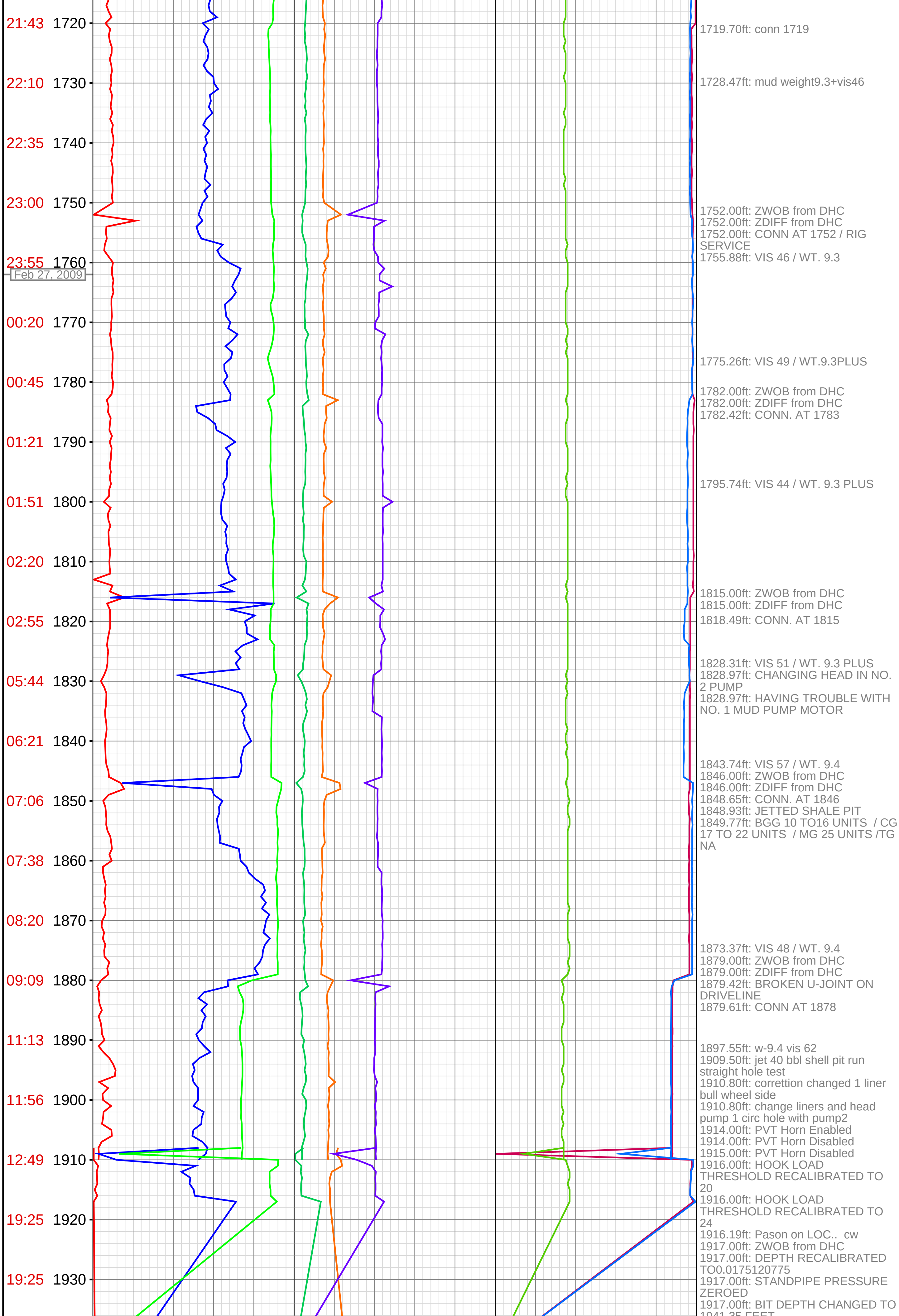

14:28 840
15:02 850
15:24 860
15:49 870
16:15 880
16:36 890
17:01 900
17:32 910
18:54 920
19:24 930
20:04 940
21:44 950
21:44 960
21:44 970
22:09 980
22:44 990
23:06 1000
Feb 23, 2009
02:50 1010
03:16 1020
03:53 1030
16:02 1040
16:37 1050
899.17ft: REMOTE: please record vis and wt every two hrs, and connection depth on pason. tvs.
903.99ft: VIS47/9+W
922.30ft: CONN-901.94
945.47ft: CIRC FOR STRAIGHT HOLE TEST
965.06ft: Connection at 965.1
997.13ft: Connection at 996.6
997.13ft: GO THROUGH PUMP
999.95ft: NO. 1 PUMP BACK ON LINE
1004.00ft: IN TALLY: HOLE DEPTH SET TO 965.1
1004.00ft: ZWOB from DHC
1004.00ft: ZWOB from DHC
1029.00ft: ZDIFF from DHC
1029.00ft: ZWOB from DHC
1029.81ft: Connection at 1028.2
1029.81ft: SHAKER MOTOR AND CHARGE PUMP MOTOR DOWN
1036.20ft: WAIT ON ELECTRIAN AND WOK PIPE
1036.45ft: B.G. 10 UNITS CON GAS 0 UNITS TG 0 UNITS.
1036.45ft: WT. 9.3 VIS.44
1036.45ft: WORK PIPE / PIPE FREE
1036.45ft: WORK PIPE
1036.45ft: worked pipe
1036.45ft: WORK pipe
1036.45ft: mud weight9.3/vis44
1036.45ft: worked pipe
1036.45ft: worked pipe
1036.45ft: work pipe
1036.45ft: worked pipe
1036.45ft: worked pipe
1036.45ft: worked pipe
1036.45ft: work pipe
1036.45ft: workeed pipe

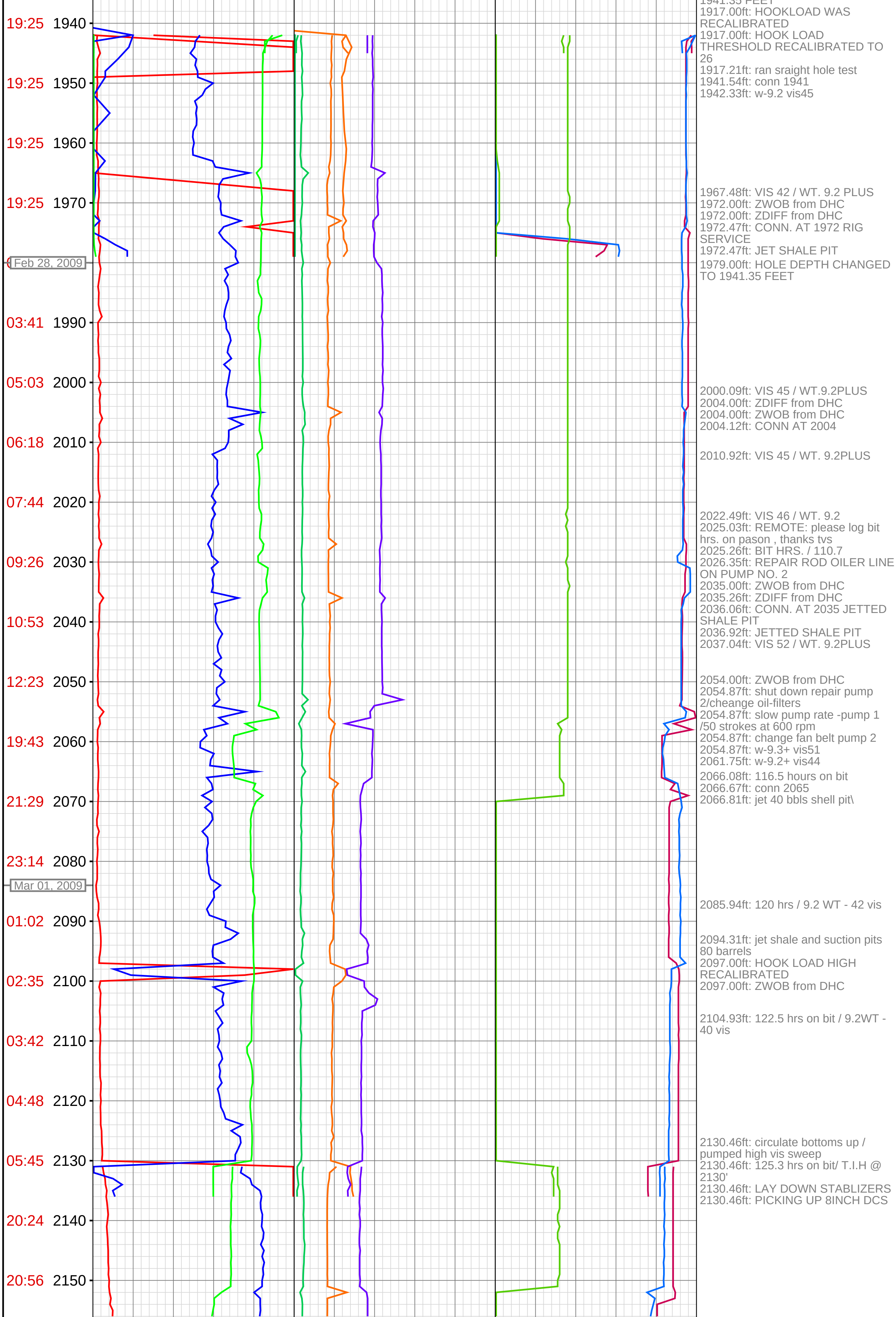


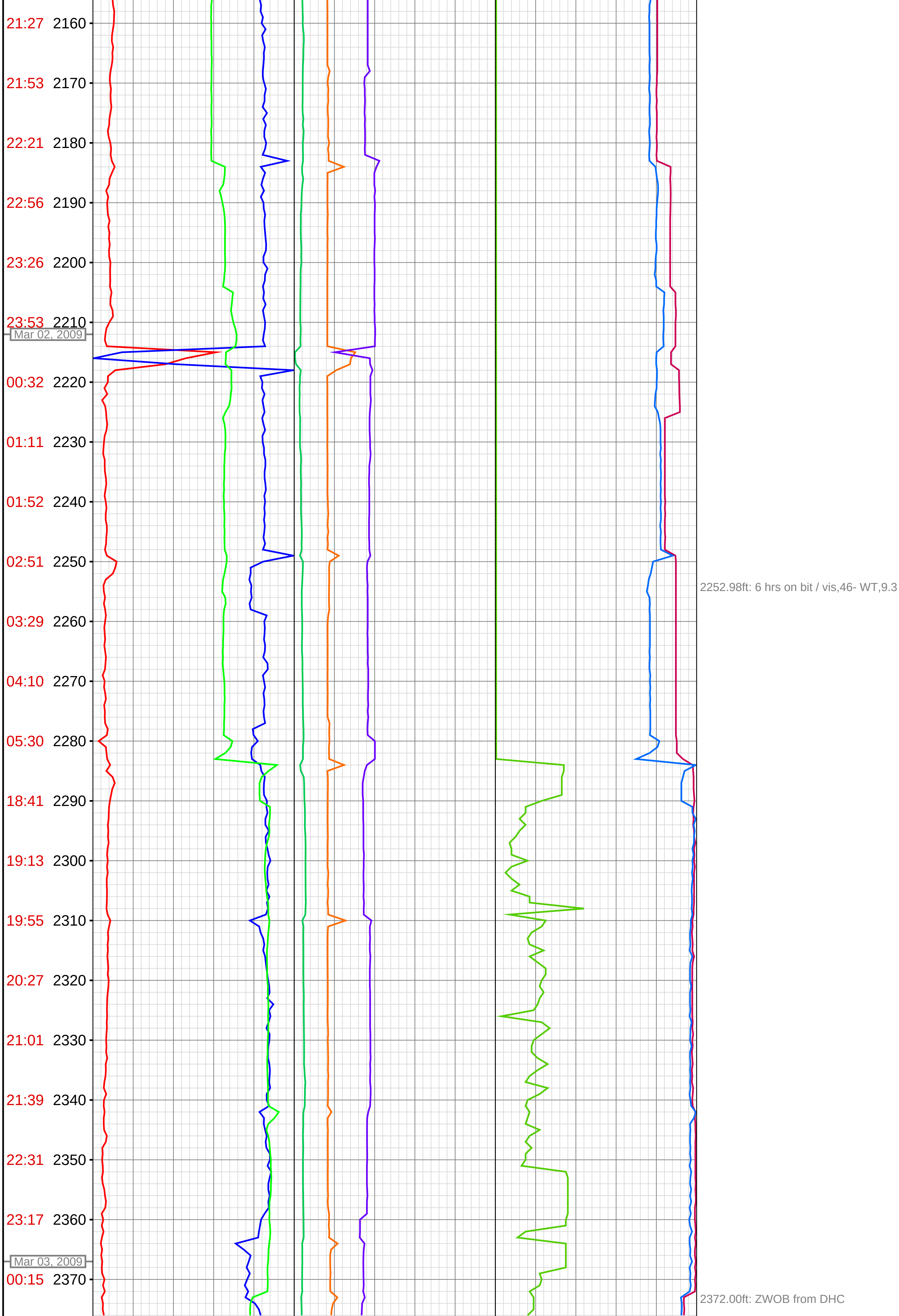
1039.34ft: lost pump pressure
1039.34ft: mud weight 9.3+/vis53
17:34 1060
1063.67ft: WORK ON PUMP 1
1063.67ft: DRILLING
1067.23ft: conn1059
19:28 1070
1077.31ft: ZWOB from DHC
1077.31ft: ZWOB from DHC
20:05 1080
20:39 1090
1096.00ft: ZWOB from SideKick
sk-05-09-1342
1096.00ft: ZWOB from DHC
1096.00ft: ZDIFF from DHC
1097.95ft: conn 1091
1098.69ft: ZWOB from DHC
1102.94ft: m.w 92+/vis50
21:31 1100
22:20 1110
22:56 1120
1122.85ft: IN TALLY: HOLE DEPTH SET TO 1122.8
1122.88ft: Connection at 1122.8
23:55 1130
Feb 24, 2009
1129.78ft: VIS. 44 WT.9.2
01:02 1140
01:18 1150
1153.30ft: Connection at 1154.2
01:57 1160
1158.23ft: VIS.46/WT.9.3
02:22 1170
02:46 1180
1185.74ft: IN TALLY: HOLE DEPTH SET TO 1185.7
1186.00ft: ZWOB from DHC
1186.37ft: Connection at 1185.7
1186.37ft: WORK ON PUMP NO. 1
1187.00ft: BELLY WIRE BACKED OUT OF TURNBUCKLE
03:44 1190
04:52 1200
1199.00ft: HOLE DEPTH CHANGED TO 1185.0 FEET
05:19 1210
1215.45ft: Connection at 1217.3
05:47 1220
06:05 1230
06:32 1240
07:17 1250
1248.33ft: Connection at 1248.9
1254.00ft: ZDIFF from DHC
07:59 1260
1260.00ft: ZDIFF from DHC
1263.00ft: ZDIFF from DHC
08:41 1270
1270.74ft: WORK ON PUMP NO. 1 / PONY ROD CLAMP FELL OFF
1271.00ft: HOOKLOAD WAS RECALIBRATED
1271.00ft: ZWOB from DHC

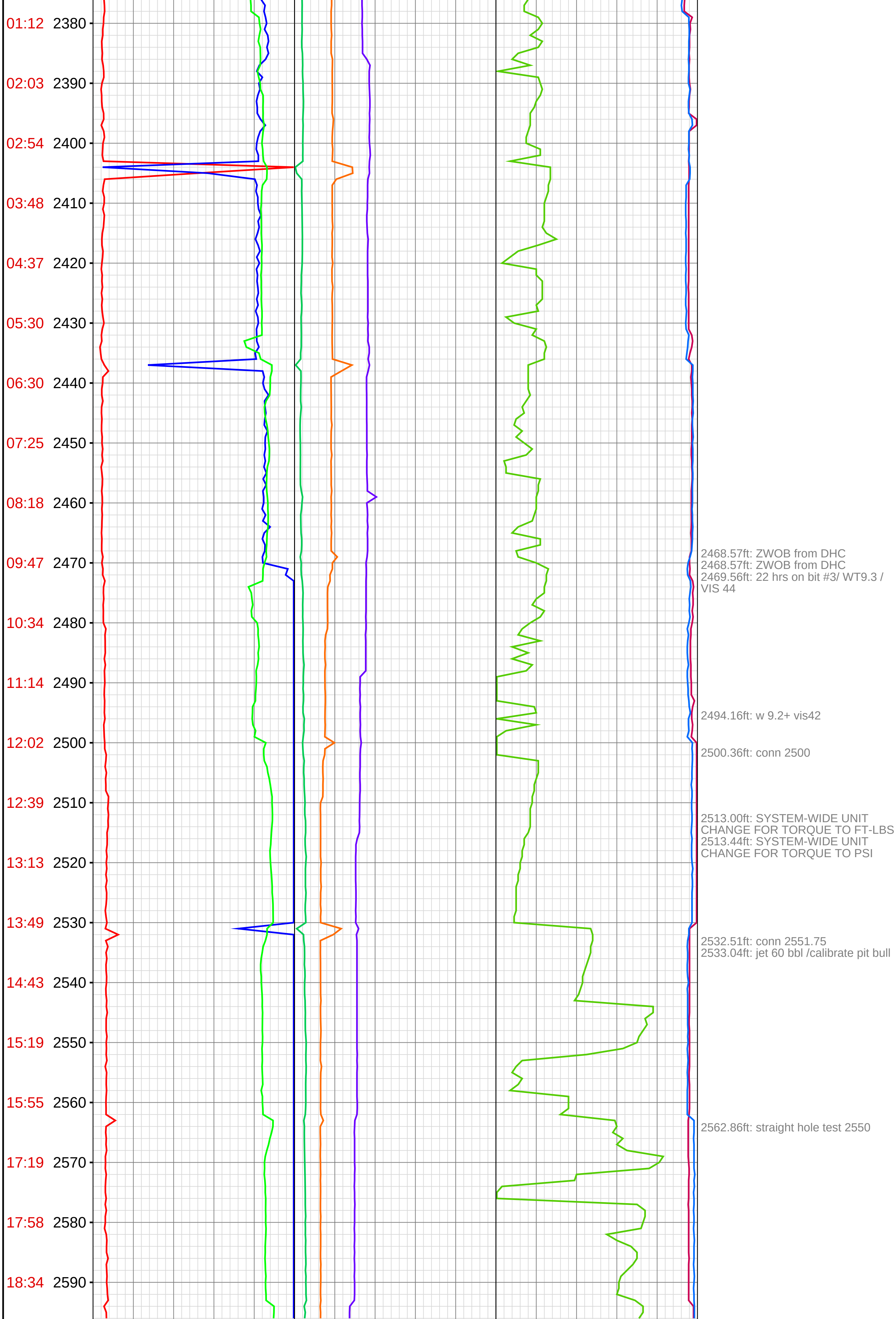

09:53 1280
12:42 1290
14:10 1300
14:12 1310
14:57 1320
16:15 1330
16:47 1340
18:48 1350
19:19 1360
20:09 1370
21:21 1380
Feb 25, 2009
04:03 1400
04:23 1410
06:36 1420
07:51 1430
09:13 1440
10:54 1450
13:09 1460
16:25 1470
17:41 1480
19:16 1490
1271.00ft: ZDIFF from DHC
1280.84ft: ran straight hole test
1289.07ft: worked pipe
1294.86ft: worked pipe
1294.86ft: worked pipe
1317.00ft: ZWOB from SideKick sk-05-09-1342
1322.00ft: ZWOB from DHC
1335.97ft: w.9.3 vis43
1348.00ft: ZWOB from SideKick sk-05-09-1342
1348.99ft: conn1280
1380.00ft: ZWOB from SideKick sk-05-09-1342
1380.47ft: conn 1380 pull tight
1386.80ft: mud w9.2 vis41
1389.00ft: PUMP 2 DISPLACEMENT RECALIBRATED
1389.00ft: PUMP 1 EFFICIENCY RECALIBRATED
1389.00ft: PUMP 2 EFFICIENCY RECALIBRATED
1389.00ft: ZDIFF from DHC
1389.00ft: ZWOB from DHC
1389.05ft: CIRCULATE REPAIR PUMPS 1 AND 2
1389.05ft: PUMP 1 DISPLACEMENT RECALIBRATED
1389.05ft: WORK PIPE/PIPE FREE
1389.05ft: NO DRAG
1389.05ft: WORK PIPE /PIPE FREE
1389.05ft: WORK PIPE /PIPE FREE
1389.05ft: WORK PIPE/PIPE FREE
1389.05ft: AIR NO. 2 PUMP OFF
1394.39ft: VIS.40/WT.9.2
1413.97ft: COOLING BOX LINE BROKE
1414.26ft: VIS.49/WT.9.2
1416.00ft: IN TALLY: HOLE DEPTH SET TO 1406.2
1416.20ft: Connection at 1406.2
1424.79ft: VIS.55/WT.9.2 PLUS
1435.27ft: TRACE OF ANHIDRITE
1438.00ft: IN TALLY: HOLE DEPTH SET TO 1437.7
1438.18ft: JET SAND TRAP
1438.41ft: Connection at 1437.7
1442.00ft: IN TALLY: HOLE DEPTH SET TO 1437.7
1459.00ft: ZWOB from SideKick sk-05-09-1342
1459.51ft: picked up off bottom to jet shell pit 50 bbl
1461.28ft: picked up off bottom to jet pit 40bbl
1465.00ft: ZWOB from SideKick sk-05-09-1342
1465.60ft: picked up off bottom to jet 40 bbl
1465.60ft: change head rubber pump 1/ middle head
1467.81ft: worked on pump 1 /clogged screen
1468.00ft: ZWOB from SideKick sk-05-09-1342
1468.39ft: weight9.1 vis69
1470.00ft: ZWOB from DHC
1488.82ft: weight 9.0+ vis50
1489.50ft: change head rubber pump 2
1489.50ft: TRACKING OFF ON PASON


OFF
1500.39ft: CONN. AT 1500.40
1502.04ft: ADDING PILL TO ACTIVE SYSTEM SLOWLY
1506.27ft: NO. 1 MUD PUMP DIED
1507.13ft: VIS. 53 / WT. 9.0
1507.65ft: NO. 1 PUMP DIED
1509.25ft: WORK ON AIR SYSTEM / TIGHTEN NO.1 PUMP BELTS
1514.00ft: ZWOB from SideKick
sk-05-09-1342
1514.31ft: jet 20 bbl shell pit /change head rubbers pump 1
1514.71ft: VIS. 52 / WT 9.0 PLUS
1516.36ft: JET SHALE PIT
1517.71ft: VIS. 55 / WT. 9.0
1522.03ft: VIS 51 / WT. 9.0
1530.00ft: HOLE DEPTH CHANGED TO 1500.0 FEET
1530.00ft: ZDIFF from DHC
1530.00ft: ZWOB from DHC
1530.42ft: VIS 51 /WT. 9.0
1531.00ft: ZWOB from DHC
1531.00ft: ZDIFF from DHC
1556.41ft: CHANGE HEAD PUMP 2
1562.00ft: BIT DEPTH CHANGED TO 1573.0 FEET
1562.79ft: CONN1563
1562.87ft: mud weight 9.0 vis 50
1623.42ft: conn 1626
1628.03ft: change head pump 1
correction repaired pump 2
1628.03ft: changed liner pump 1
1628.03ft: mud weight 8.9 vis 51
1656.77ft: Connection at 1657.6
1668.07ft: mud weight 9.1 vis 51
1687.85ft: Connection at 1720.7
correct depth 1688
20:08 1500
21:32 1510
Feb 26, 2009
01:14 1520
01:46 1530
10:27 1540
11:00 1550
12:25 1560
13:51 1570
14:22 1580
14:53 1590
15:26 1600
15:47 1610
16:06 1620
17:30 1630
17:51 1640
18:17 1650
18:44 1660
19:05 1670
19:28 1680
20:02 1690
20:33 1700
21:05 1710

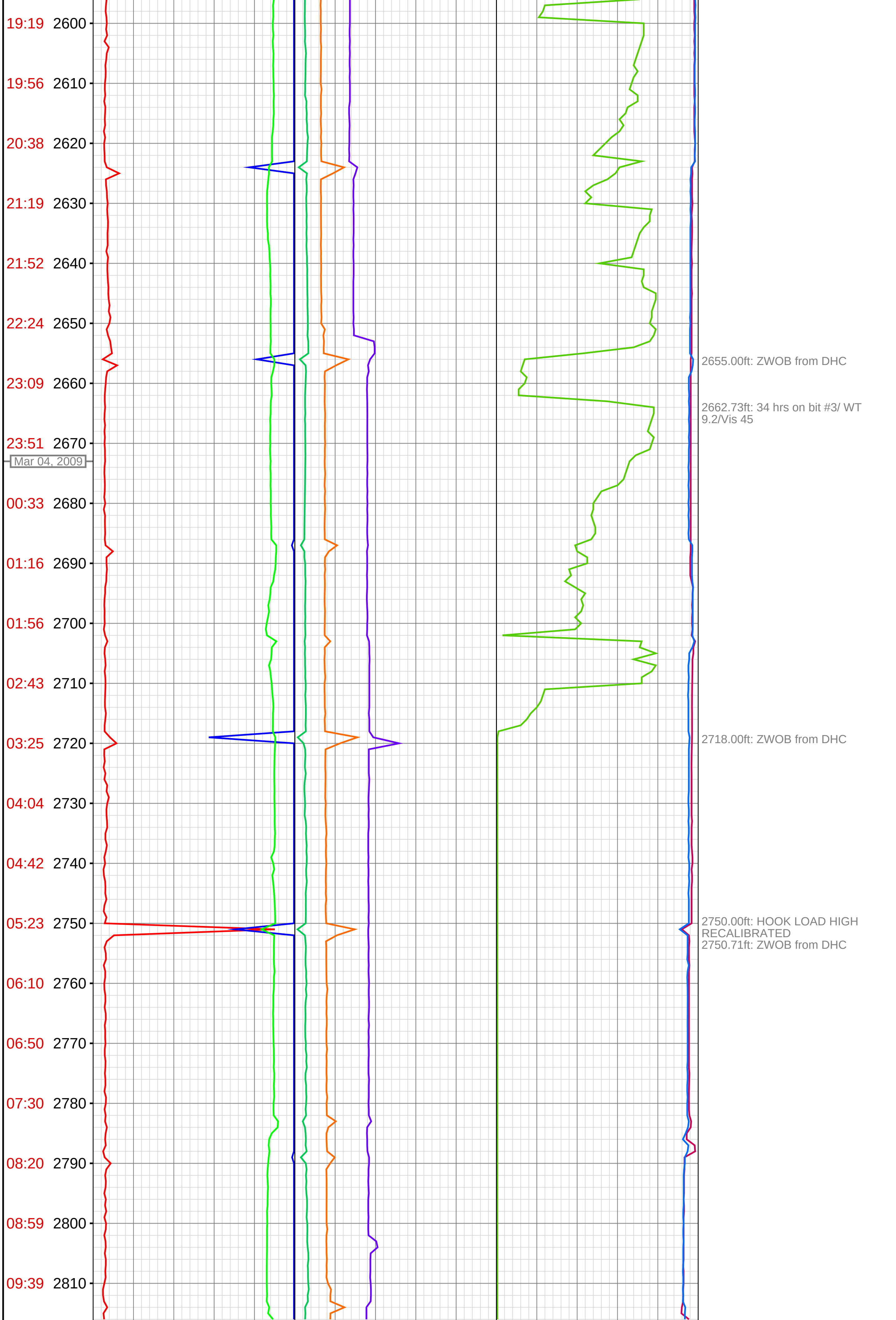

21:43 1720
22:10 1730
22:35 1740
23:00 1750
23:55 1760
Feb 27, 2009
00:20 1770
00:45 1780
01:21 1790
01:51 1800
02:20 1810
02:55 1820
05:44 1830
06:21 1840
07:06 1850
07:38 1860
08:20 1870
09:09 1880
11:13 1890
11:56 1900
12:49 1910
19:25 1920
19:25 1930
1719.70ft: conn 1719
1728.47ft: mud weight9.3+vis46
1752.00ft: ZWOB from DHC
1752.00ft: ZDIFF from DHC
1752.00ft: CONN AT 1752 / RIG SERVICE
1755.88ft: VIS 46 / WT. 9.3
1775.26ft: VIS 49 / WT.9.3PLUS
1782.00ft: ZWOB from DHC
1782.00ft: ZDIFF from DHC
1782.42ft: CONN. AT 1783
1795.74ft: VIS 44 / WT. 9.3 PLUS
1815.00ft: ZWOB from DHC
1815.00ft: ZDIFF from DHC
1818.49ft: CONN. AT 1815
1828.31ft: VIS 51 / WT. 9.3 PLUS
1828.97ft: CHANGING HEAD IN NO. 2 PUMP
1828.97ft: HAVING TROUBLE WITH NO. 1 MUD PUMP MOTOR
1843.74ft: VIS 57 / WT. 9.4
1846.00ft: ZWOB from DHC
1846.00ft: ZDIFF from DHC
1848.65ft: CONN. AT 1846
1848.93ft: JETTED SHALE PIT
1849.77ft: BGG 10 TO16 UNITS / CG 17 TO 22 UNITS / MG 25 UNITS /TG NA
1873.37ft: VIS 48 / WT. 9.4
1879.00ft: ZWOB from DHC
1879.00ft: ZDIFF from DHC
1879.42ft: BROKEN U-JOINT ON DRIVELINE
1879.61ft: CONN AT 1878
1897.55ft: w-9.4 vis 62
1909.50ft: jet 40 bbl shell pit run straight hole test
1910.80ft: corretion changed 1 liner bull wheel side
1910.80ft: change liners and head pump 1 circ hole with pump2
1914.00ft: PVT Horn Enabled
1914.00ft: PVT Horn Disabled
1915.00ft: PVT Horn Disabled
1916.00ft: HOOK LOAD THRESHOLD RECALIBRATED TO 20
1916.00ft: HOOK LOAD THRESHOLD RECALIBRATED TO 24
1916.19ft: Pason on LOC.. cw
1917.00ft: ZWOB from DHC
1917.00ft: DEPTH RECALIBRATED TO0.0175120775
1917.00ft: STANDPIPE PRESSURE ZEROED
1917.00ft: BIT DEPTH CHANGED TO

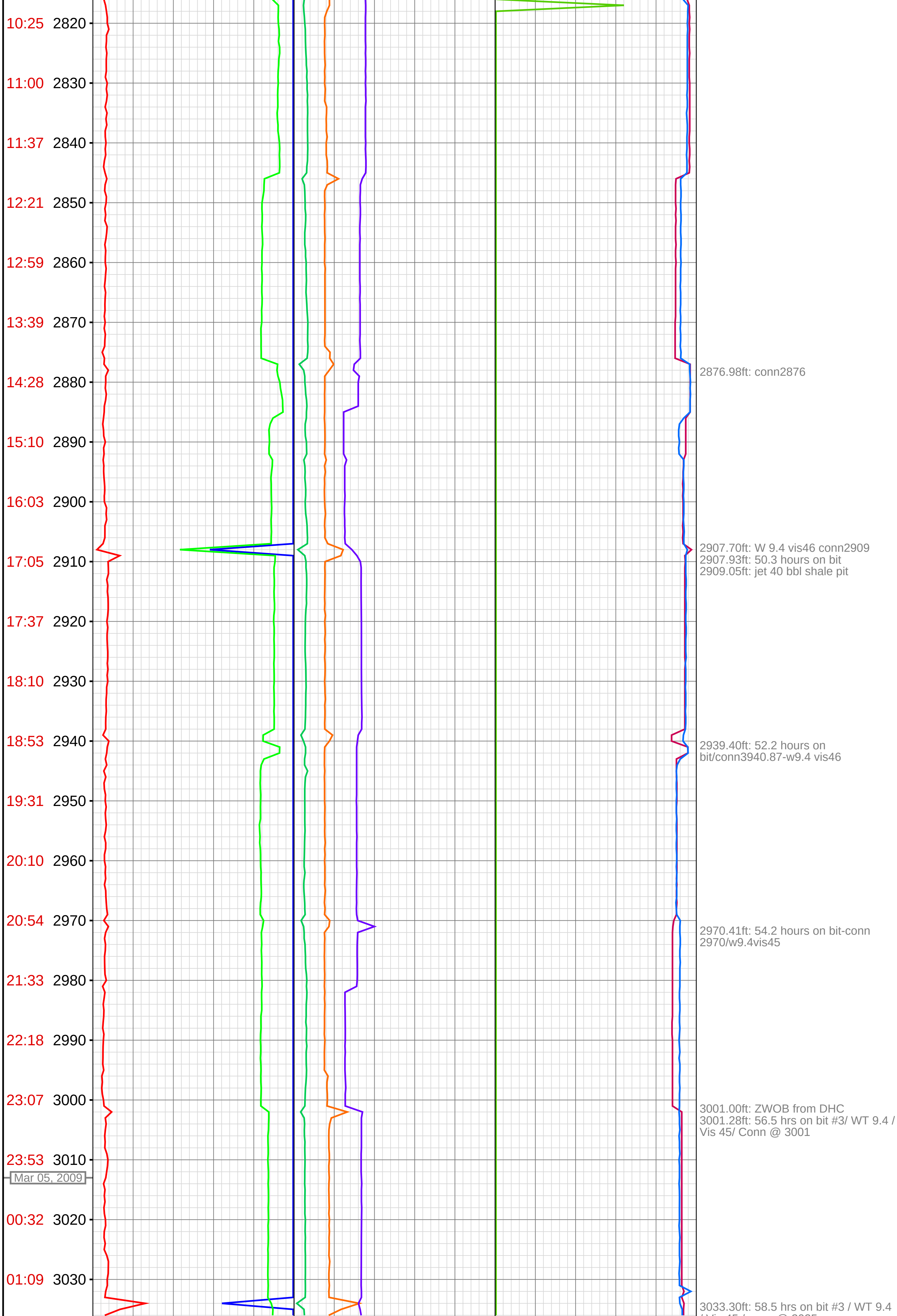

1941.35 FEET
1917.00ft: HOOKLOAD WAS RECALIBRATED
1917.00ft: HOOK LOAD THRESHOLD RECALIBRATED TO 26
1917.21ft: ran sraight hole test
1941.54ft: conn 1941
1942.33ft: w-9.2 vis45
1967.48ft: VIS 42 / WT. 9.2 PLUS
1972.00ft: ZWOB from DHC
1972.00ft: ZDIFF from DHC
1972.47ft: CONN. AT 1972 RIG SERVICE
1972.47ft: JET SHALE PIT
1979.00ft: HOLE DEPTH CHANGED TO 1941.35 FEET
2000.09ft: VIS 45 / WT.9.2PLUS
2004.00ft: ZDIFF from DHC
2004.00ft: ZWOB from DHC
2004.12ft: CONN AT 2004
2010.92ft: VIS 45 / WT. 9.2PLUS
2022.49ft: VIS 46 / WT. 9.2
2025.03ft: REMOTE: please log bit hrs. on pason , thanks tvs
2025.26ft: BIT HRS. / 110.7
2026.35ft: REPAIR ROD OILER LINE ON PUMP NO. 2
2035.00ft: ZWOB from DHC
2035.26ft: ZDIFF from DHC
2036.06ft: CONN. AT 2035 JETTED SHALE PIT
2036.92ft: JETTED SHALE PIT
2037.04ft: VIS 52 / WT. 9.2PLUS
2054.00ft: ZWOB from DHC
2054.87ft: shut down repair pump 2/cheange oil-filters
2054.87ft: slow pump rate -pump 1 /50 strokes at 600 rpm
2054.87ft: change fan belt pump 2
2054.87ft: w-9.3+ vis51
2061.75ft: w-9.2+ vis44
2066.08ft: 116.5 hours on bit
2066.67ft: conn 2065
2066.81ft: jet 40 bbls shell pit\
2085.94ft: 120 hrs / 9.2 WT - 42 vis
2094.31ft: jet shale and suction pits 80 barrels
2097.00ft: HOOK LOAD HIGH RECALIBRATED
2097.00ft: ZWOB from DHC
2104.93ft: 122.5 hrs on bit / 9.2WT - 40 vis
2130.46ft: circulate bottoms up / pumped high vis sweep
2130.46ft: 125.3 hrs on bit/ T.I.H @ 2130'
2130.46ft: LAY DOWN STABLIZERS
2130.46ft: PICKING UP 8INCH DCS
19:25 1940
19:25 1950
19:25 1960
19:25 1970
Feb 28, 2009
03:41 1990
05:03 2000
06:18 2010
07:44 2020
09:26 2030
10:53 2040
12:23 2050
19:43 2060
21:29 2070
23:14 2080
Mar 01, 2009
01:02 2090
02:35 2100
03:42 2110
04:48 2120
05:45 2130
20:24 2140
20:56 2150

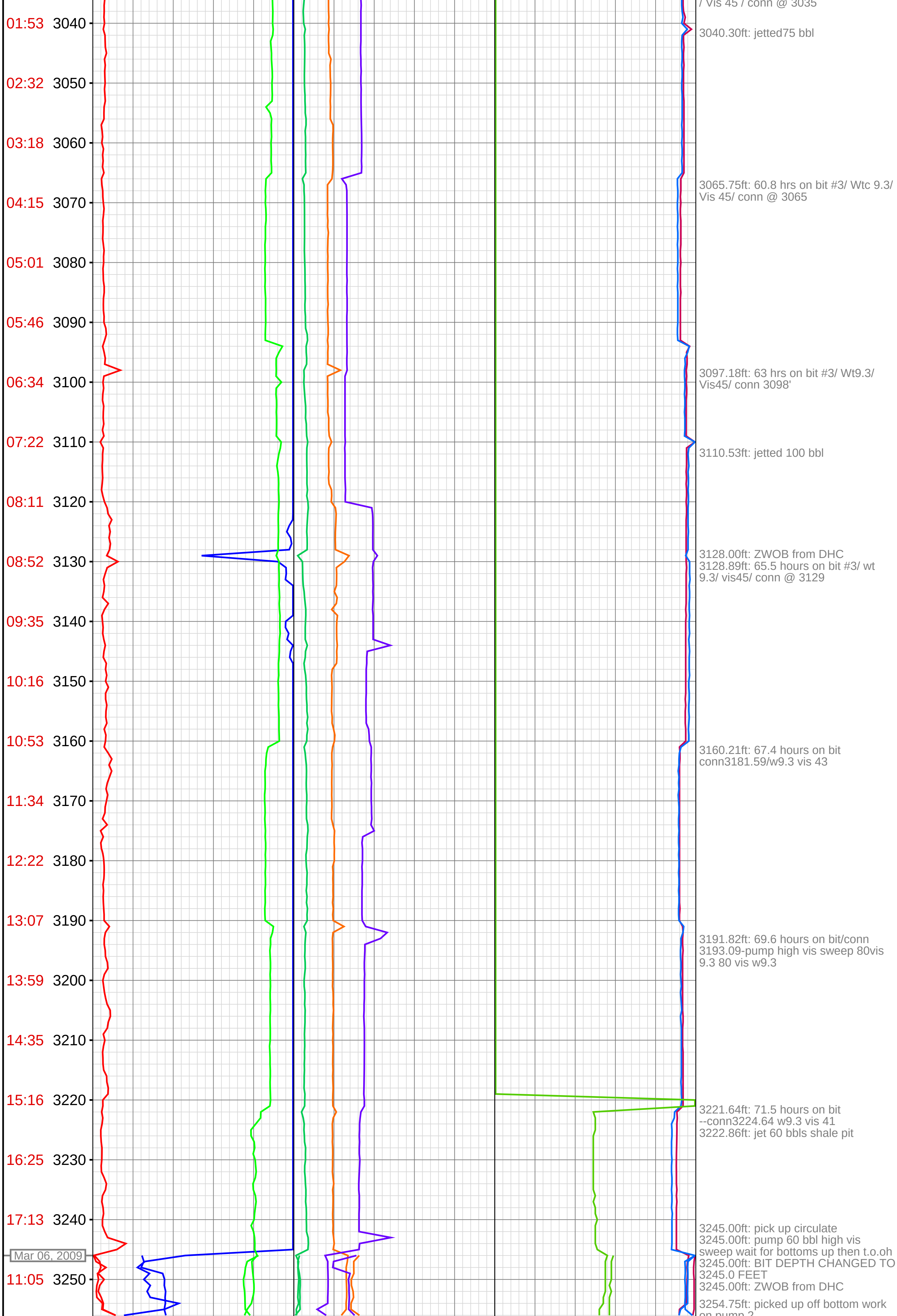

21:27 2160
21:53 2170
22:21 2180
22:56 2190
23:26 2200
23:53 2210
Mar 02, 2009
00:32 2220
01:11 2230
01:52 2240
02:51 2250
2252.98ft: 6 hrs on bit / vis,46- WT,9.3
03:29 2260
04:10 2270
05:30 2280
18:41 2290
19:13 2300
19:55 2310
20:27 2320
21:01 2330
21:39 2340
22:31 2350
23:17 2360
Mar 03, 2009
00:15 2370
2372.00ft: ZWOB from DHC



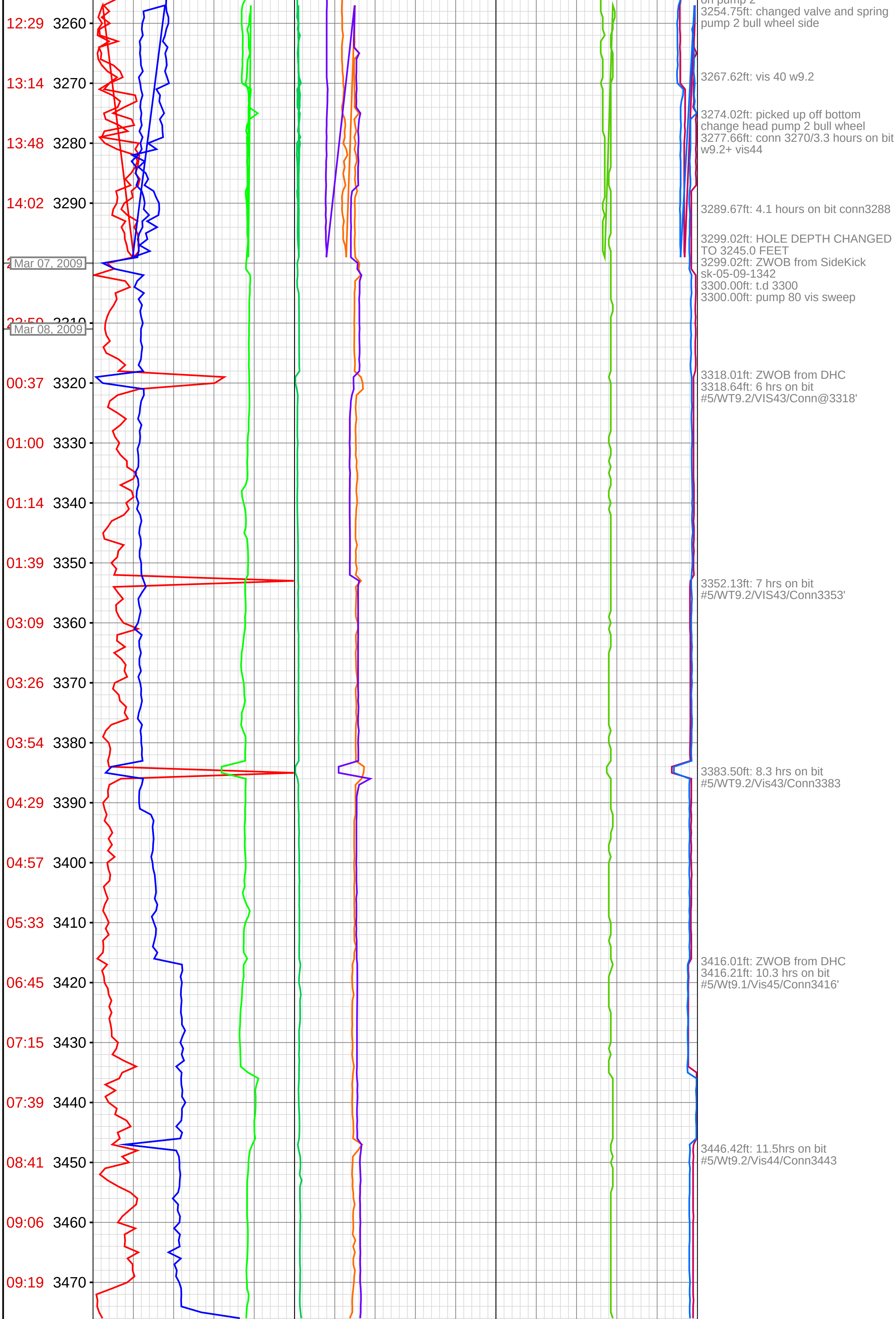
01:12 2380
02:03 2390
02:54 2400
03:48 2410
04:37 2420
05:30 2430
06:30 2440
07:25 2450
08:18 2460
09:47 2470
10:34 2480
11:14 2490
12:02 2500
12:39 2510
13:13 2520
13:49 2530
14:43 2540
15:19 2550
15:55 2560
17:19 2570
17:58 2580
18:34 2590
2468.57ft: ZWOB from DHC
2468.57ft: ZWOB from DHC
2469.56ft: 22 hrs on bit #3/ WT9.3 / VIS 44
2494.16ft: w 9.2+ vis42
2500.36ft: conn 2500
2513.00ft: SYSTEM-WIDE UNIT CHANGE FOR TORQUE TO FT-LBS
2513.44ft: SYSTEM-WIDE UNIT CHANGE FOR TORQUE TO PSI
2532.51ft: conn 2551.75
2533.04ft: jet 60 bbl /calibrate pit bull
2562.86ft: straight hole test 2550


19:19 2600
19:56 2610
20:38 2620
21:19 2630
21:52 2640
22:24 2650
23:09 2660
23:51 2670
Mar 04, 2009
00:33 2680
01:16 2690
01:56 2700
02:43 2710
03:25 2720
04:04 2730
04:42 2740
05:23 2750
06:10 2760
06:50 2770
07:30 2780
08:20 2790
08:59 2800
09:39 2810
2655.00ft: ZWOB from DHC
2662.73ft: 34 hrs on bit #3/ WT
9.2/Vis 45
2718.00ft: ZWOB from DHC
2750.00ft: HOOK LOAD HIGH
RECALIBRATED
2750.71ft: ZWOB from DHC

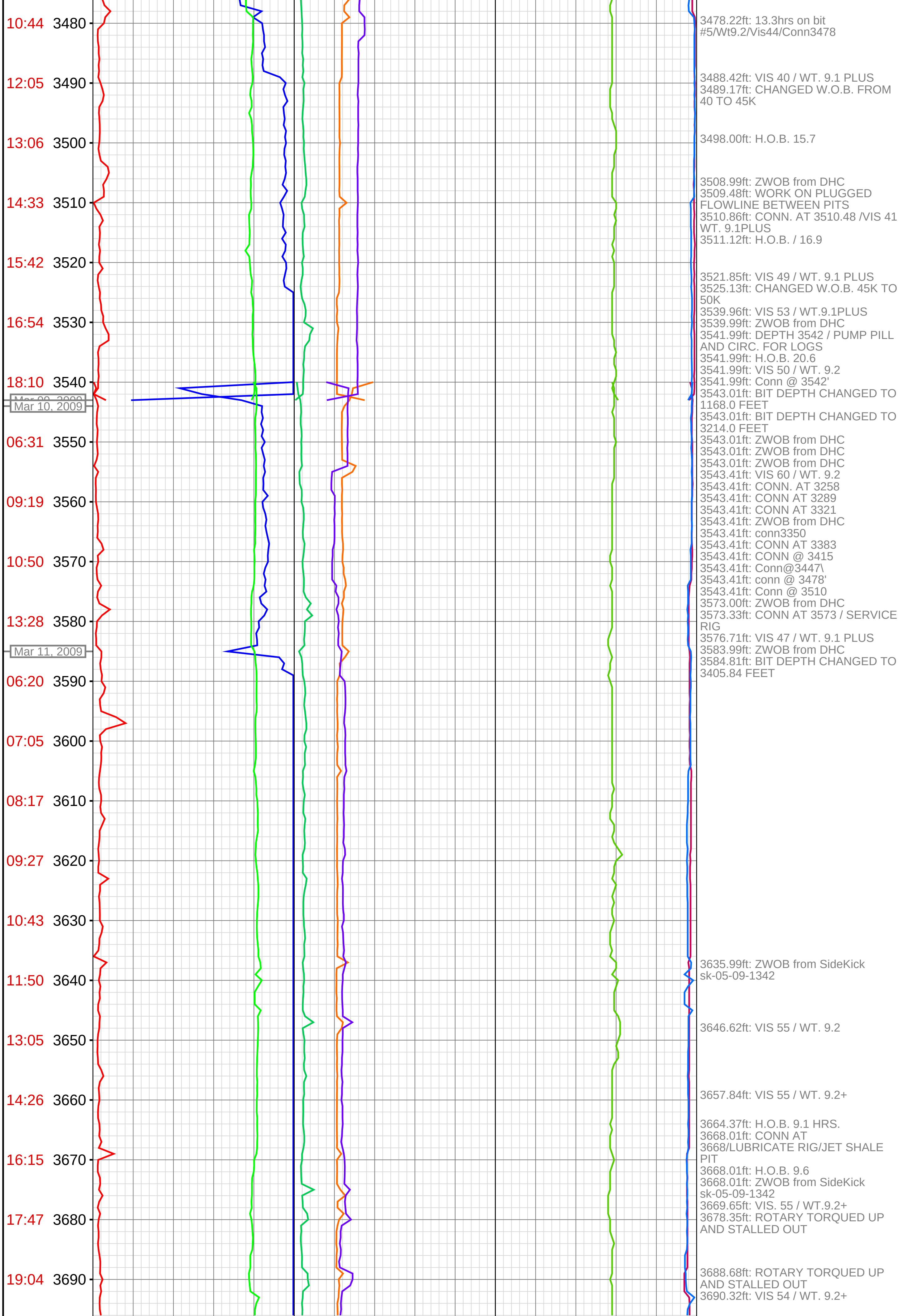

10:25 2820
11:00 2830
11:37 2840
12:21 2850
12:59 2860
13:39 2870
14:28 2880
15:10 2890
16:03 2900
17:05 2910
17:37 2920
18:10 2930
18:53 2940
19:31 2950
20:10 2960
20:54 2970
21:33 2980
22:18 2990
23:07 3000
23:53 3010
Mar 05, 2009
00:32 3020
01:09 3030
2876.98ft: conn2876
2907.70ft: W 9.4 vis46 conn2909
2907.93ft: 50.3 hours on bit
2909.05ft: jet 40 bbl shale pit
2939.40ft: 52.2 hours on bit/conn3940.87-w9.4 vis46
2970.41ft: 54.2 hours on bit-conn 2970/w9.4vis45
3001.00ft: ZWOB from DHC
3001.28ft: 56.5 hrs on bit #3/ WT 9.4 / Vis 45/ Conn @ 3001
3033.30ft: 58.5 hrs on bit #3 / WT 9.4

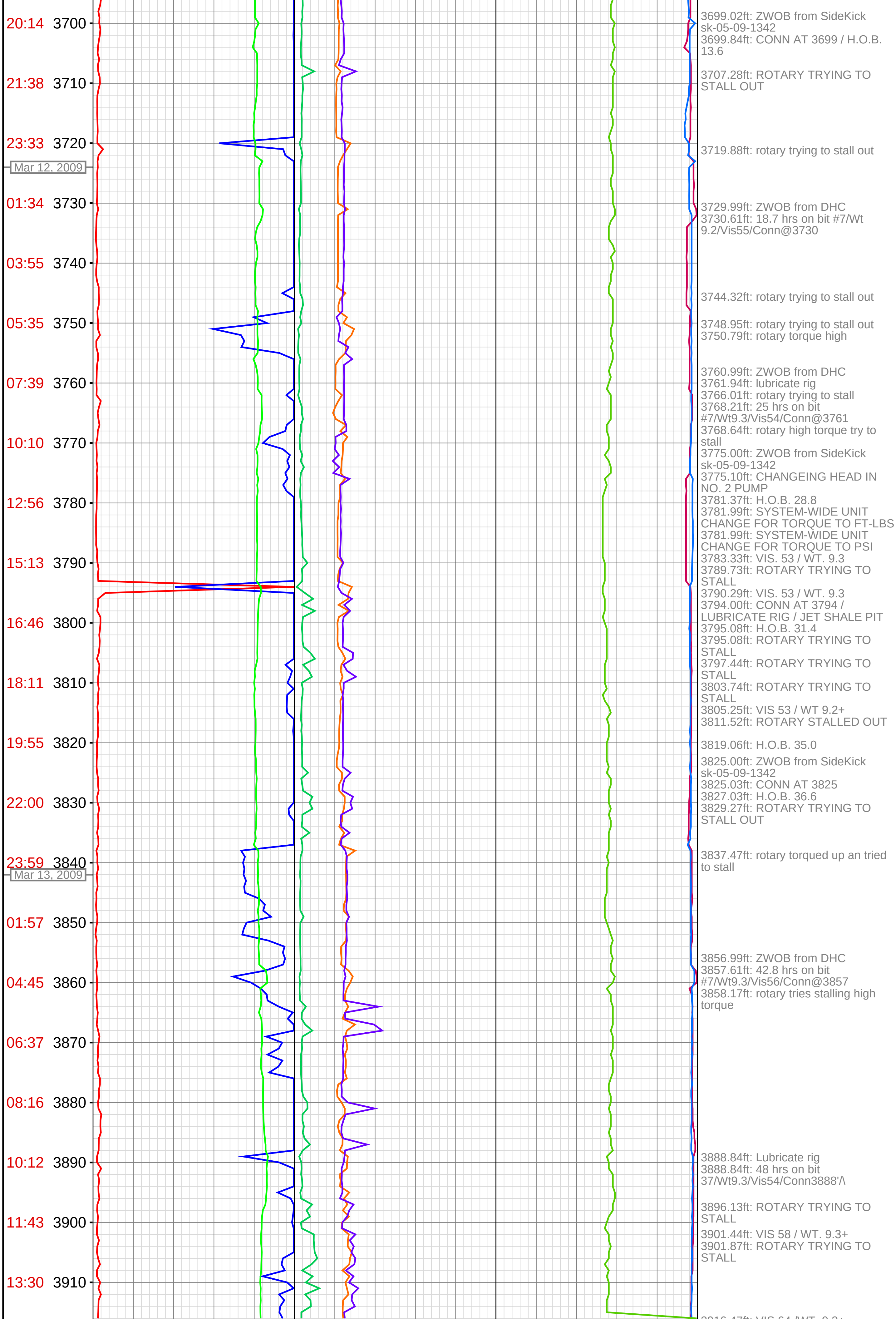


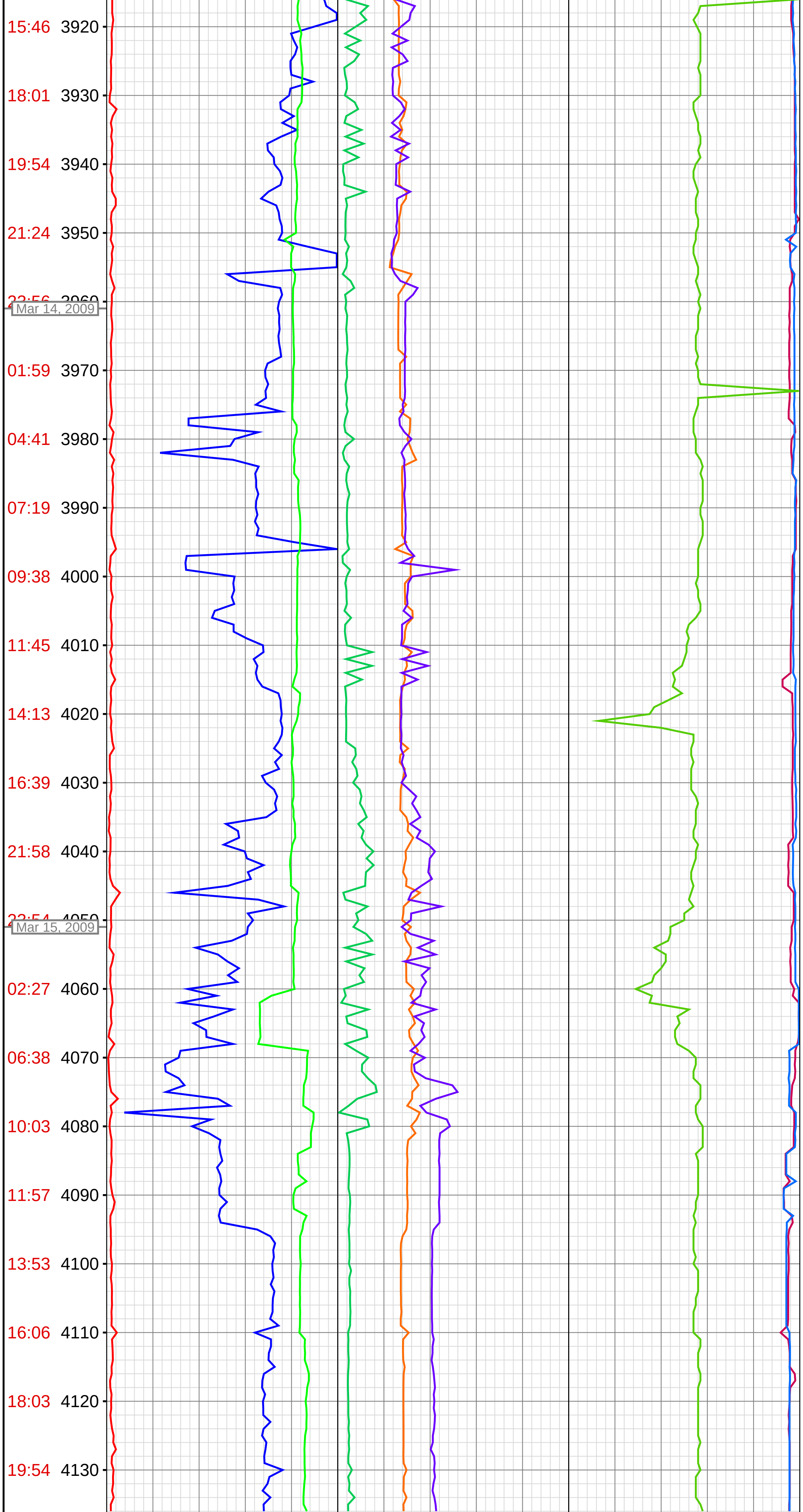
01:53 3040
02:32 3050
03:18 3060
04:15 3070
05:01 3080
05:46 3090
06:34 3100
07:22 3110
08:11 3120
08:52 3130
09:35 3140
10:16 3150
10:53 3160
11:34 3170
12:22 3180
13:07 3190
13:59 3200
14:35 3210
15:16 3220
16:25 3230
17:13 3240
Mar 06, 2009
11:05 3250
/ Vis 45 / conn @ 3035
3040.30ft: jetted75 bbl
3065.75ft: 60.8 hrs on bit #3/ Wtc 9.3/ Vis 45/ conn @ 3065
3097.18ft: 63 hrs on bit #3/ Wt9.3/ Vis45/ conn 3098'
3110.53ft: jetted 100 bbl
3128.00ft: ZWOB from DHC
3128.89ft: 65.5 hours on bit #3/ wt 9.3/ vis45/ conn @ 3129
3160.21ft: 67.4 hours on bit conn3181.59/w9.3 vis 43
3191.82ft: 69.6 hours on bit/conn
3193.09-pump high vis sweep 80vis 9.3 80 vis w9.3
3221.64ft: 71.5 hours on bit --conn3224.64 w9.3 vis 41
3222.86ft: jet 60 bbls shale pit
3245.00ft: pick up circulate
3245.00ft: pump 60 bbl high vis sweep wait for bottoms up then t.o.oh
3245.00ft: BIT DEPTH CHANGED TO 3245.0 FEET
3245.00ft: ZWOB from DHC
3254.75ft: picked up off bottom work on pump 2



12:29 3260
13:14 3270
13:48 3280
14:02 3290
Mar 07, 2009
Mar 08, 2009
00:37 3320
01:00 3330
01:14 3340
01:39 3350
03:09 3360
03:26 3370
03:54 3380
04:29 3390
04:57 3400
05:33 3410
06:45 3420
07:15 3430
07:39 3440
08:41 3450
09:06 3460
09:19 3470
3254.75ft: changed valve and spring
pump 2 bull wheel side
3267.62ft: vis 40 w9.2
3274.02ft: picked up off bottom
change head pump 2 bull wheel
3277.66ft: conn 3270/3.3 hours on bit
w9.2+ vis44
3289.67ft: 4.1 hours on bit conn3288
3299.02ft: HOLE DEPTH CHANGED
TO 3245.0 FEET
3299.02ft: ZWOB from SideKick
sk-05-09-1342
3300.00ft: t.d 3300
3300.00ft: pump 80 vis sweep
3318.01ft: ZWOB from DHC
3318.64ft: 6 hrs on bit
#5/WT9.2/VIS43/Conn@3318'
3352.13ft: 7 hrs on bit
#5/WT9.2/VIS43/Conn3353'
3383.50ft: 8.3 hrs on bit
#5/WT9.2/Vis43/Conn3383
3416.01ft: ZWOB from DHC
3416.21ft: 10.3 hrs on bit
#5/Wt9.1/Vis45/Conn3416'
3446.42ft: 11.5hrs on bit
#5/Wt9.2/Vis44/Conn3443


10:44 3480
12:05 3490
13:06 3500
14:33 3510
15:42 3520
16:54 3530
18:10 3540
Mar 10, 2009
06:31 3550
09:19 3560
10:50 3570
13:28 3580
Mar 11, 2009
06:20 3590
07:05 3600
08:17 3610
09:27 3620
10:43 3630
11:50 3640
13:05 3650
14:26 3660
16:15 3670
17:47 3680
19:04 3690
3478.22ft: 13.3hrs on bit #5/Wt9.2/Vis44/Conn3478
3488.42ft: VIS 40 / WT. 9.1 PLUS
3489.17ft: CHANGED W.O.B. FROM 40 TO 45K
3498.00ft: H.O.B. 15.7
3508.99ft: ZWOB from DHC
3509.48ft: WORK ON PLUGGED FLOWLINE BETWEEN PITS
3510.86ft: CONN. AT 3510.48 /VIS 41 WT. 9.1PLUS
3511.12ft: H.O.B. / 16.9
3521.85ft: VIS 49 / WT. 9.1 PLUS
3525.13ft: CHANGED W.O.B. 45K TO 50K
3539.96ft: VIS 53 / WT.9.1PLUS
3539.99ft: ZWOB from DHC
3541.99ft: DEPTH 3542 / PUMP PILL AND CIRC. FOR LOGS
3541.99ft: H.O.B. 20.6
3541.99ft: VIS 50 / WT. 9.2
3541.99ft: Conn @ 3542'
3543.01ft: BIT DEPTH CHANGED TO 1168.0 FEET
3543.01ft: BIT DEPTH CHANGED TO 3214.0 FEET
3543.01ft: ZWOB from DHC
3543.01ft: ZWOB from DHC
3543.01ft: ZWOB from DHC
3543.41ft: VIS 60 / WT. 9.2
3543.41ft: CONN. AT 3258
3543.41ft: CONN AT 3289
3543.41ft: CONN AT 3321
3543.41ft: ZWOB from DHC
3543.41ft: conn3350
3543.41ft: CONN AT 3383
3543.41ft: CONN @ 3415
3543.41ft: Conn@3447\
3543.41ft: conn @ 3478'
3543.41ft: Conn @ 3510
3573.00ft: ZWOB from DHC
3573.33ft: CONN AT 3573 / SERVICE RIG
3576.71ft: VIS 47 / WT. 9.1 PLUS
3583.99ft: ZWOB from DHC
3584.81ft: BIT DEPTH CHANGED TO 3405.84 FEET
3635.99ft: ZWOB from SideKick sk-05-09-1342
3646.62ft: VIS 55 / WT. 9.2
3657.84ft: VIS 55 / WT. 9.2+
3664.37ft: H.O.B. 9.1 HRS.
3668.01ft: CONN AT 3668/LUBRICATE RIG/JET SHALE PIT
3668.01ft: H.O.B. 9.6
3668.01ft: ZWOB from SideKick sk-05-09-1342
3669.65ft: VIS. 55 / WT.9.2+
3678.35ft: ROTARY TORQUED UP AND STALLED OUT
3688.68ft: ROTARY TORQUED UP AND STALLED OUT
3690.32ft: VIS 54 / WT. 9.2+

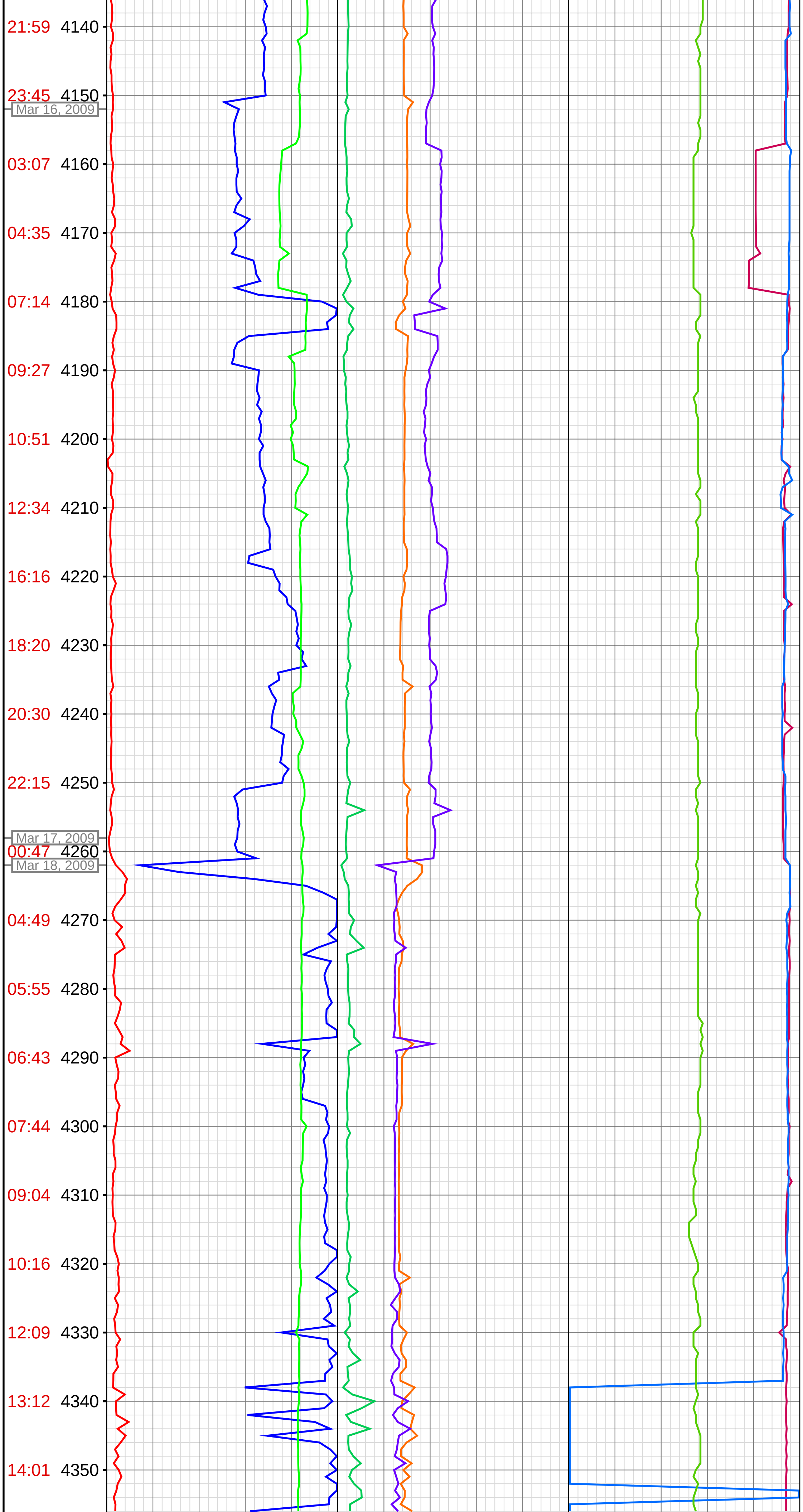

20:14 3700
21:38 3710
23:33 3720
Mar 12, 2009
01:34 3730
03:55 3740
05:35 3750
07:39 3760
10:10 3770
12:56 3780
15:13 3790
16:46 3800
18:11 3810
19:55 3820
22:00 3830
23:59 3840
Mar 13, 2009
01:57 3850
04:45 3860
06:37 3870
08:16 3880
10:12 3890
11:43 3900
13:30 3910
3699.02ft: ZWOB from SideKick sk-05-09-1342
3699.84ft: CONN AT 3699 / H.O.B. 13.6
3707.28ft: ROTARY TRYING TO STALL OUT
3719.88ft: rotary trying to stall out
3729.99ft: ZWOB from DHC
3730.61ft: 18.7 hrs on bit #7/Wt 9.2/Vis55/Conn@3730
3744.32ft: rotary trying to stall out
3748.95ft: rotary trying to stall out
3750.79ft: rotary torque high
3760.99ft: ZWOB from DHC
3761.94ft: lubricate rig
3766.01ft: rotary trying to stall
3768.21ft: 25 hrs on bit #7/Wt9.3/Vis54/Conn@3761
3768.64ft: rotary high torque try to stall
3775.00ft: ZWOB from SideKick sk-05-09-1342
3775.10ft: CHANGEING HEAD IN NO. 2 PUMP
3781.37ft: H.O.B. 28.8
3781.99ft: SYSTEM-WIDE UNIT CHANGE FOR TORQUE TO FT-LBS
3781.99ft: SYSTEM-WIDE UNIT CHANGE FOR TORQUE TO PSI
3783.33ft: VIS. 53 / WT. 9.3
3789.73ft: ROTARY TRYING TO STALL
3790.29ft: VIS. 53 / WT. 9.3
3794.00ft: CONN AT 3794 / LUBRICATE RIG / JET SHALE PIT
3795.08ft: H.O.B. 31.4
3795.08ft: ROTARY TRYING TO STALL
3797.44ft: ROTARY TRYING TO STALL
3803.74ft: ROTARY TRYING TO STALL
3805.25ft: VIS 53 / WT 9.2+
3811.52ft: ROTARY STALLED OUT
3819.06ft: H.O.B. 35.0
3825.00ft: ZWOB from SideKick sk-05-09-1342
3825.03ft: CONN AT 3825
3827.03ft: H.O.B. 36.6
3829.27ft: ROTARY TRYING TO STALL OUT
3837.47ft: rotary torqued up an tried to stall
3856.99ft: ZWOB from DHC
3857.61ft: 42.8 hrs on bit #7/Wt9.3/Vis56/Conn@3857
3858.17ft: rotary tries stalling high torque
3888.84ft: Lubricate rig
3888.84ft: 48 hrs on bit 37/Wt9.3/Vis54/Conn3888'/\
3896.13ft: ROTARY TRYING TO STALL
3901.44ft: VIS 58 / WT. 9.3+
3901.87ft: ROTARY TRYING TO STALL



3916.47ft: VIS 64 /WT. 9.3+
3919.00ft: ZWOB from SideKick sk-05-09-1342
3920.01ft: CONN. AT 3920 / LUBRICATE RIG
3920.14ft: H.O.B. 52.9

3929.13ft: VIS. 58 / WT. 9.2+
3930.61ft: ROTARY TRYING TO STALL

3950.98ft: ZWOB from SideKick sk-05-09-1342
3950.98ft: CONN AT 3951 / JET SHALE PIT
3950.98ft: H.O.B. 58.9
3954.99ft: ZWOB from DHC
3955.48ft: high torque
3956.82ft: 60RPM on bit 20/50 on bit keeps torquing up
3958.07ft: 70 RPM/ 35k on bit smooth out torque drilling better
3967.06ft: high torque
3974.05ft: high torque
3977.03ft: high torque
3977.13ft: 65rpm/15k on bit drilling smooth again
3979.76ft: high torque
3981.99ft: ZWOB from SideKick sk-05-09-1342
3982.22ft: lubricate rig
3982.22ft: 65.2 hrs on bit #7/Wt9.2/Vis58/Conn@3882
4009.22ft: VIS 50 / WT. 9.3
4013.35ft: CONN AT 4014 / LUBRICATE RIG / H.O.B. 71.1
4014.01ft: ZWOB from SideKick sk-05-09-1342
4016.40ft: VIS 50 / WT. 9.3
4024.11ft: VIS 49 / WT 9.3
4032.38ft: VIS 52 / WT. 9.2+
4037.21ft: VIS 53 / WT. 9.2+
4037.99ft: ZWOB from SideKick sk-05-09-1342
4038.12ft: 77HRS ON BIT 7
4038.19ft: SURVEY 1DEG 3998FT
4038.19ft: SHORT TRIP
4060.99ft: ZWOB from SideKick sk-05-09-1342
4061.81ft: replaced 5 valves -4 springs pump 2
4064.01ft: ZWOB from SideKick sk-05-09-1342
4064.34ft: changed rotary to 90 rpm
4065.78ft: sped up rotary to 90 drilled with lower torque faster r.o.p
4065.88ft: slowed rotary back to 60 rpm
4066.08ft: sl9owed rotary to 60 r.p.m took 5000 lbs of bit lowered rop
4066.14ft: increased torque
4067.06ft: changed rotary back to 90
4068.04ft: drilled faster and smoother with faster rotation
4068.31ft: slowed rotary to 70 rpm
4068.47ft: picked up off bottom to air off pumps
4068.50ft: correction bit progam
4068.77ft: slowed rotary to requested rpm 60
4069.39ft: stopped rotary picked up off bottom /set back down slow
4072.54ft: torqued up and stopped drilling \
4073.06ft: had trouble getting bit on bottom
4074.34ft: had to increase rotary to 100 rpm to get back drilling
4077.20ft: 86.7 hours on bit conn 4078 w9.2= vis58
4087.27ft: VIS 58 / WT. 9.3
4094.88ft: VIS 59 / WT.9.3
4094.95ft: H.O.B. 90.5
4095.64ft: ADDING WT. TO BIT STARTING AT 4095
4108.96ft: CONN. AT 4109/LUBRICATE RIG
4108.99ft: ZWOB from SideKick sk-05-09-1342
4108.99ft: ZWOB from SideKick sk-05-09-1342
4108.99ft: ZWOB from SideKick sk-05-09-1342
4108.99ft: ZWOB from SideKick sk-05-09-1342
4108.99ft: ZWOB from SideKick sk-05-09-1342
4110.14ft: VIS 70 / WT. 9.3+
4110.37ft: H.O.B. 93.4
4121.29ft: VIS 70 / WT. 9.3+
4123.62ft: H.O.B. 96.1
4139.99ft: ZWOB from SideKick sk-05-09-1342
4140.16ft: CONN. @ 4140 / JET SHALE PIT / H.O.B. 98.8
4150.07ft: torqued up stopped rotary had to pick up set down slow
4150.16ft: less weight/15000 lbs on bit
4157.28ft: repair oil line pump 1/line wore a hole due to vibration



4171.56ft: conn 4172=weight9.2 vis53
4171.62ft: hours on bit 104.3
4178.08ft: shut down to replace hose on pump 1
4181.76ft: slowed rotary increased weight to 45000
4185.04ft: torqued up stopped rotary had to pick up and work to bottom
4185.14ft: increased rotary to 110, took 15000 off bit
4187.83ft: change head pump 1
4187.83ft: changed liner pump 1
4187.83ft: jet shale pit 60 bbls
4202.99ft: ZWOB from SideKick sk-05-09-1342
4204.33ft: CONN. @ 4204 / LUBRICATE RIG / H.O.B. 109.4
4207.05ft: VIS 52 / WT. 9.2+
4211.84ft: WORK ON #1 MUD PUMP /REPLACE LEAKING OIL LINE
4215.81ft: RAISED RPM F/100 T/110 & LOWERED WT. F/33 T/28
4218.14ft: VIS 50 / WT. 9.2+
4218.64ft: W.O.B. 33 / R.P.M. 115
4222.31ft: W.O.B.36
4223.43ft: ROT. RPM 100
4232.68ft: W.O.B. 35
4235.01ft: ZWOB from SideKick sk-05-09-1342
4235.04ft: CONN. AT 4235/JETTED SHALE PIT/H.O.B.115.3
4242.13ft: H.O.B.116.7
4249.48ft: VIS 58 / 9.3+
4250.00ft: ZWOB from SideKick sk-05-09-1342
4250.56ft: ROTARY STALLED OUT
4260.99ft: BIT DEPTH CHANGED TO 917.0 FEET
4260.99ft: ZWOB from SideKick sk-05-09-1342
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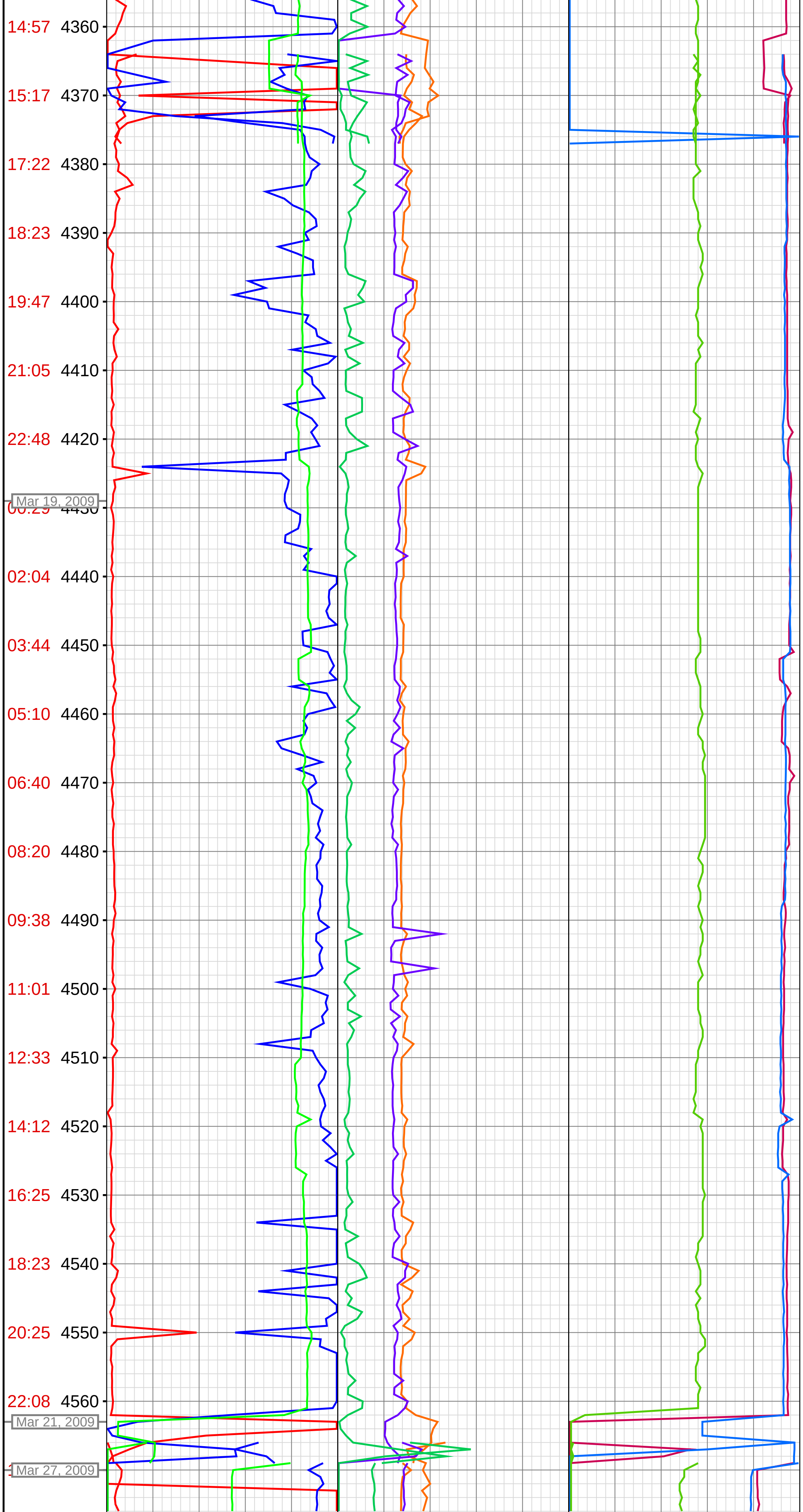
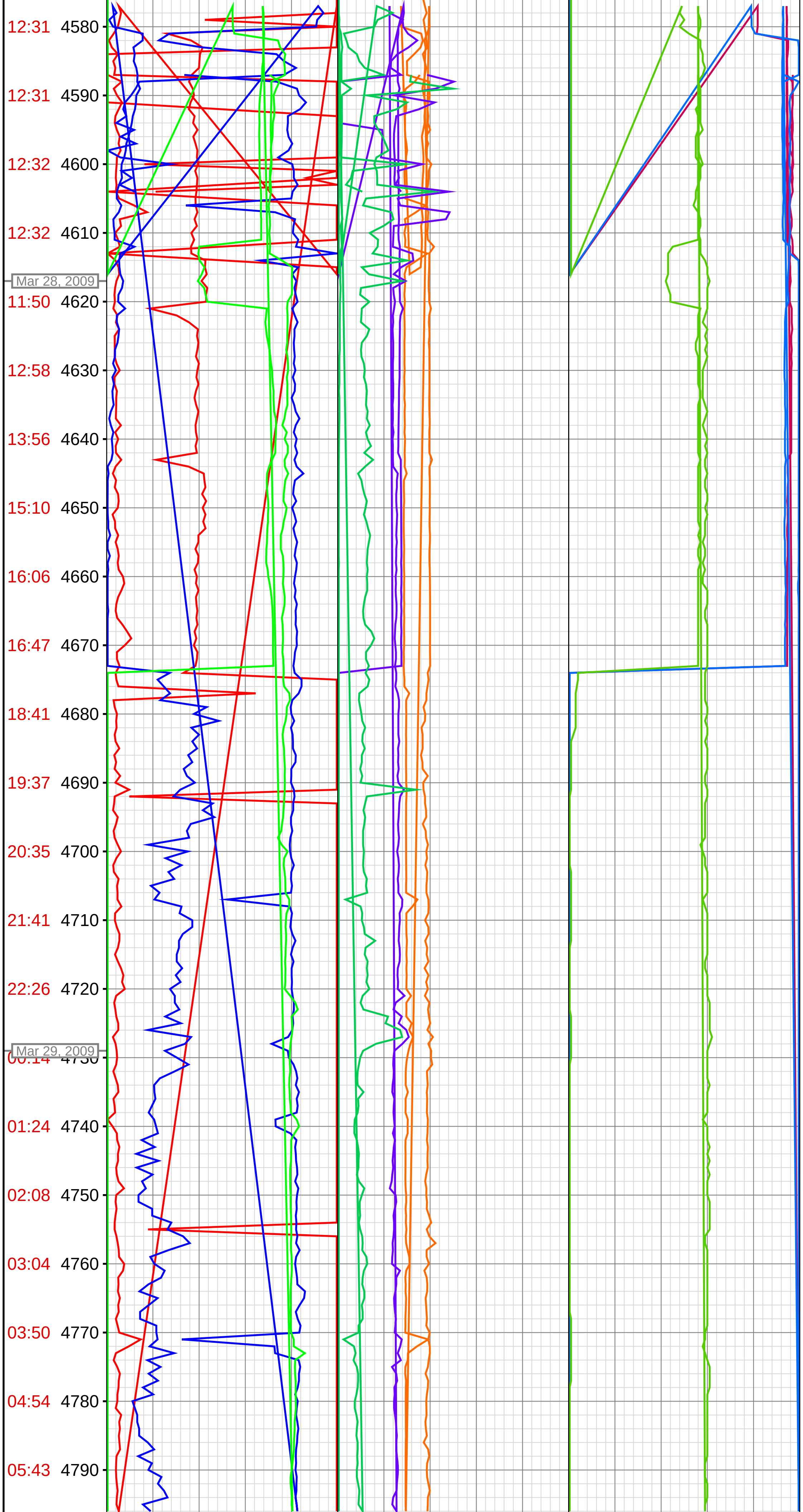
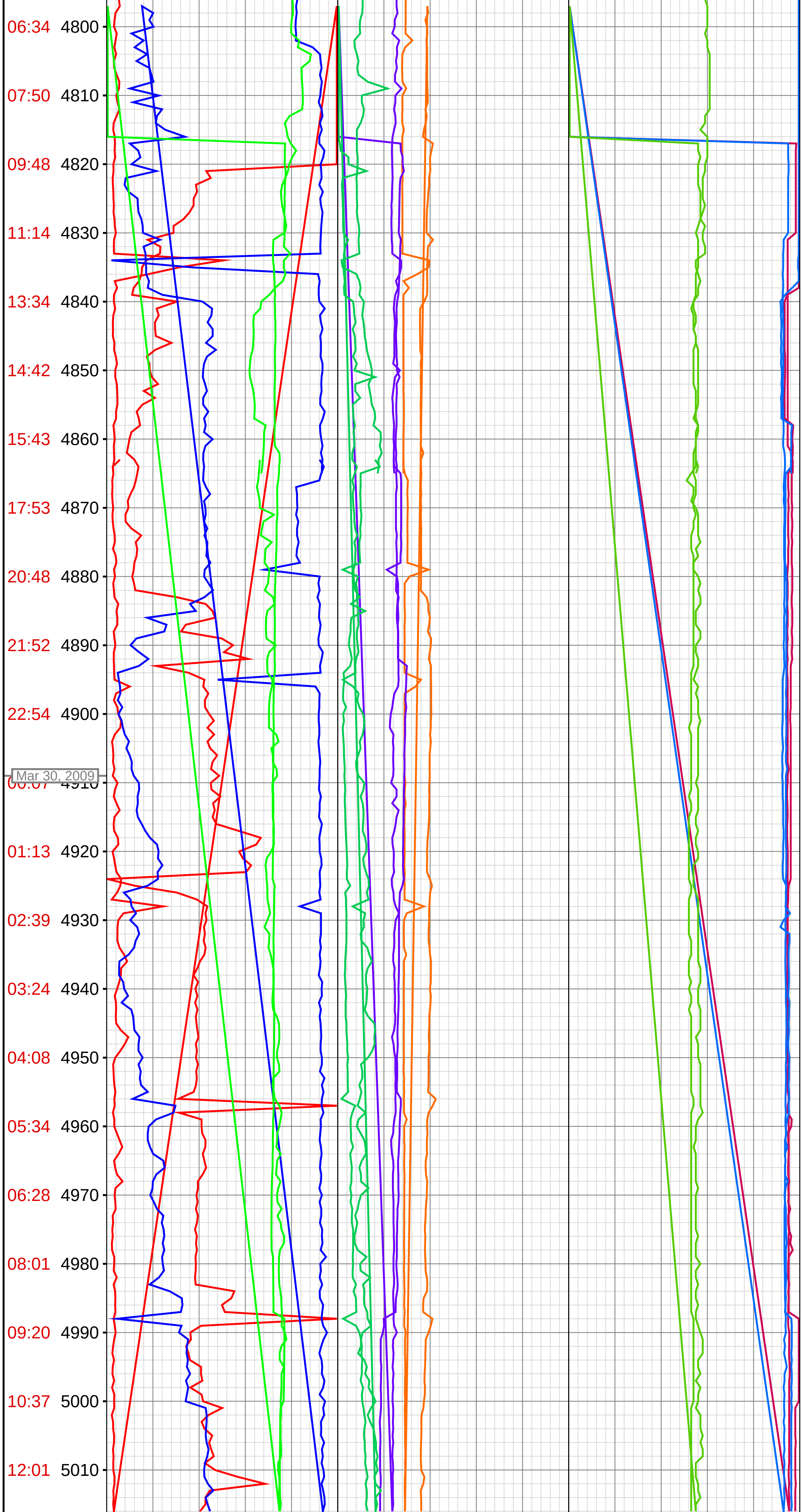
4260.99ft: ZWOB from SideKick sk-05-09-1342
4260.99ft: BIT DEPTH CHANGED TO 4171.0 FEET
4260.99ft: ZWOB from SideKick sk-05-09-1342
4260.99ft: ZWOB from SideKick sk-05-09-1342
4261.25ft: STALLED ROTARY,HAD PROBLEMS GETTING BIT BACK TO BOTTOM
4261.78ft: STALLED ROTARY HAD TO PICK UP WORK DOWN TO BOTTOM DECREASED WEIGHT TO 20000
4261.78ft: STALLED ROTARY TROUBLE RETURNING TO BOTTOM TRY TO DECREASE WEIGHT TO 15000 ON BIT
4261.81ft: ROTARY STALLED, WITH 14000 LBS ON BIT,1/10 OF A FOOT OFF BOTTOM
4273.52ft: increased torque decreaswed wieght on bit to 40000
4288.94ft: rotary stalled back off weight 5000 lbs off bit
4298.59ft: conn 4299/3 hours on bit weight9.2 vis52
4321.52ft: GO THRU #2 MUD PUMP
4327.79ft: VIS 54 / WT. 9.2+
4329.00ft: ZWOB from SideKick sk-05-09-1342
4329.99ft: CONN @ 4330
4331.53ft: H.O.B. 7
4338.16ft: ROTARY TORQUEING UP
4348.10ft: STROKE COUNTER ON #2 PUMP IS BROKEN
4369.00ft: ZWOB from SideKick sk-05-09-1342 ZWOB from SideKick sk-05-09-1342
4369.32ft: VIS 52 / WT.9.3
4372.24ft: ROTARY STALLED
4373.00ft: ZWOB from SideKick sk-05-09-1342
4373.00ft: ZWOB from SideKick sk-05-09-1342
4374.02ft: ZWOB from SideKick sk-05-09-1342
4374.02ft: ZWOB from SideKick sk-05-09-1342
4374.67ft: CONN AT 4361 / LUBRICATE RIG
4377.00ft: BIT DEPTH CHANGED TO 4351.0 FEET
4377.00ft: ZWOB from SideKick sk-05-09-1342
4377.00ft: HOLE DEPTH CHANGED



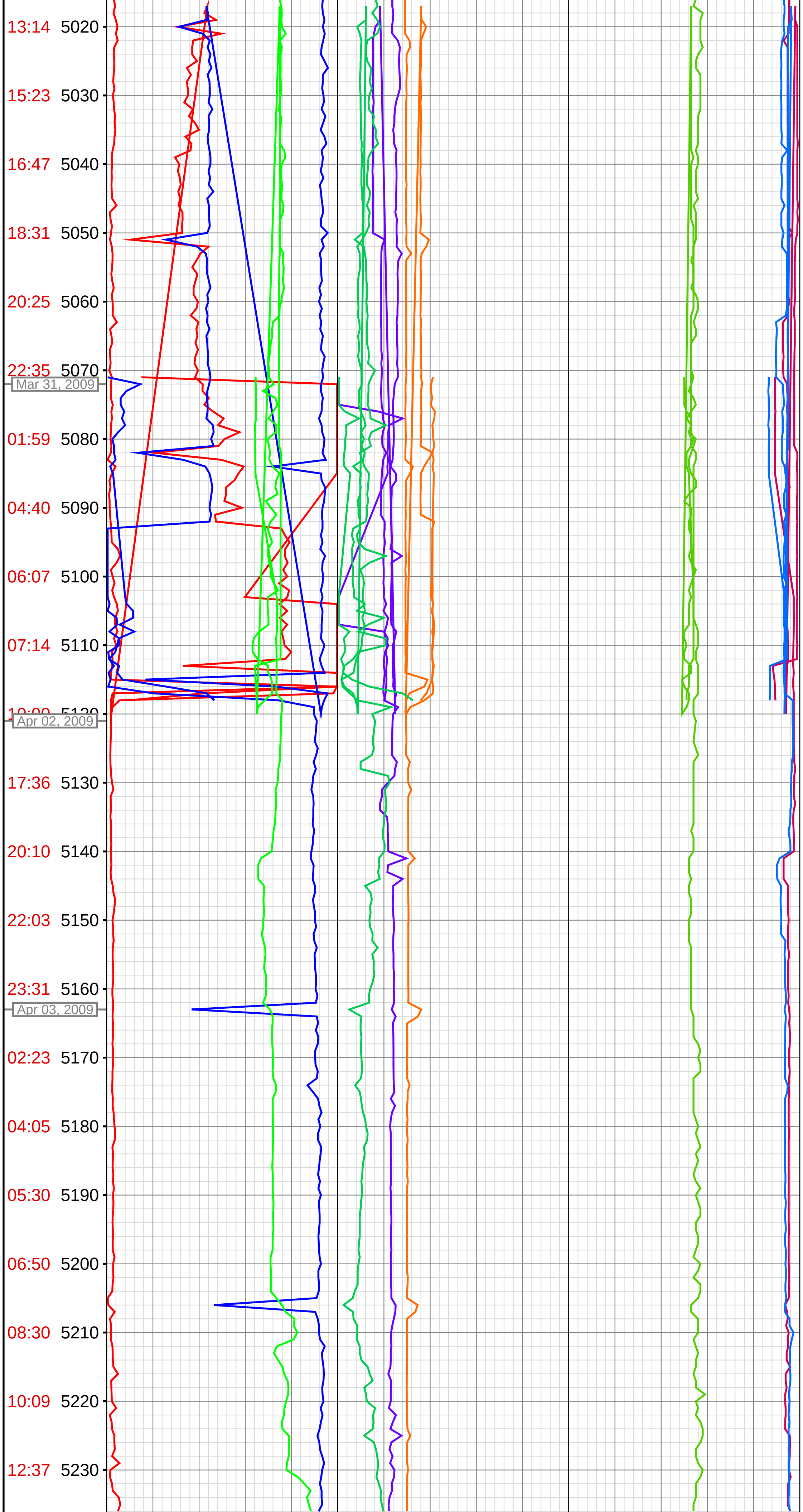
TO 4363.8 FEET
4377.49ft: H.O.B. 10.0
4391.01ft: ZWOB from SideKick sk-05-09-1342
4392.42ft: CONN @ 4392 / H.O.B.12.5
4395.24ft: ROTARY STALLED
4397.80ft: VIS 54 / WT. 9.2
4404.30ft: ROTARY TRYING TO STALL
4406.27ft: ROTARY STALLED
4414.96ft: ROTARY TRYING TO STALL
4420.90ft: torqued up took 5000 off bit
4423.88ft: conn 4423/17.3 hours on bit/weight9.2 vis 51
4454.99ft: ZWOB from SideKick sk-05-09-1342
4455.58ft: CONN 4455 -HOURS ON BIT 22.2 - WEIGHT 9.1 VIS 51
4464.04ft: TORQUE UP STALLED ROTARY HAD TO PICK TAKE 5000 OFF BIT
4486.94ft: CONN4487/26.5 HOURS ON BIT/VIS 60 WEIGHT 9.3+
4499.41ft: ROTARY STALLED
4507.78ft: ROTARY STALLED
4509.55ft: VIS 54 / WT. 9.2+
4518.01ft: ZWOB from SideKick sk-05-09-1342
4518.73ft: CONN.@ 4518 / H.O.B. 31.3
4523.23ft: VIS 57 / WT. 9.2
4533.89ft: ROTARY STALLED
4540.16ft: ROTARY STALLED
4543.83ft: ROTARY STALLED
4549.02ft: ZWOB from SideKick sk-05-09-1342
4549.97ft: CONN@4550 / LUBRICATE RIG / H.O.B. 37.1
4561.91ft: lost all circulation /can not see fluid in casing
4562.01ft: TORQUE LOW READING RECALIBRATED
4562.01ft: TORQUE HIGH READING RECALIBRATED
4562.01ft: ZERO PUMP2 from SideKick sk-05-09-1342
4562.01ft: ZERO PUMP2 from SideKick sk-05-09-1342
4562.04ft: L.c.m sweep pumped on bottom at midnight
4562.04ft: pumped second l.c.m sweep to bottom
4562.04ft: no pump pressure or circulation when pumping sweep
4562.04ft: pumped third l.c.m sweep to bottom /no stand pipe pressure
4562.04ft: PUMP LCM PILL
4562.04ft: T.O.O.H. 17 STANDS
4562.04ft: BUILD VOLUME & MIX GEL/CHEMICALS & LCM
4562.04ft: PUMP SODIUM SILICATE & CALCIUM CHLORIDE PILL
4564.99ft: PUT RIG PUMP ON HOLE & DRILL APPRX. 3FT. OF FORMATION
4566.01ft: PUMP SODIUM SILICATE & CALCIUM CHLORIDE PILL
4566.01ft: BUILD VOLUME / MIX GEL,CHEMICALS & LCM
4566.01ft: PUMP LCM PILL/NO RETURNS
4566.01ft: LCM PILL WAS 40 BBL.
4566.01ft: MAX. PSI 58 @ 69SPM
4566.01ft: Pumped l.c.m pill 40bbls max 80 p.s.i no returns 54 S.P.M
4566.01ft: pumped 40 bbl l.c.m. pill pressure constant at 140p.s.i 65 s.p.m
4566.01ft: Pumped 40bbl l.c.m. pill 157 constant pressure 63 s.p.m
4566.01ft: no returns
4566.01ft: pumped 40bbl l.c.m 269 constant pressure 63 s.p.m no returns
4566.01ft: T.O.O.H@ 3:45 to 1000' fill on way out
4566.01ft: start pumping to break circulation
4566.01ft: ZWOB from DHC
4566.01ft: broke circulation@ 6:40
4566.01ft: Run in 3 stands break circulation again
4566.01ft: ZDIFF from DHC
4566.01ft: ZDIFF from DHC
4566.01ft: Run in 3 more stands,hit a tight spot break circulation@1320
4566.01ft: ran 6 stands drill pipe 1931 no fluid loss 494bbls
4566.01ft: no fluid loss mud weight 8.4 vis 30 9.0 ph
4566.01ft: T.I.H / Ream tight spots
4566.01ft: Ran 11 stands in hole
4566.01ft: DISPLACE FLUIDS
4566.01ft: ZDIFF from DHC
4566.01ft: ZWOB from SideKick sk-05-09-1342
4566.01ft: ZWOB from SideKick sk-05-09-1342
4566.01ft: ZWOB from SideKick sk-05-09-1342
4566.01ft: ZWOB from SideKick sk-05-09-1342
4566.01ft: REAMING/HIGH TORQUE



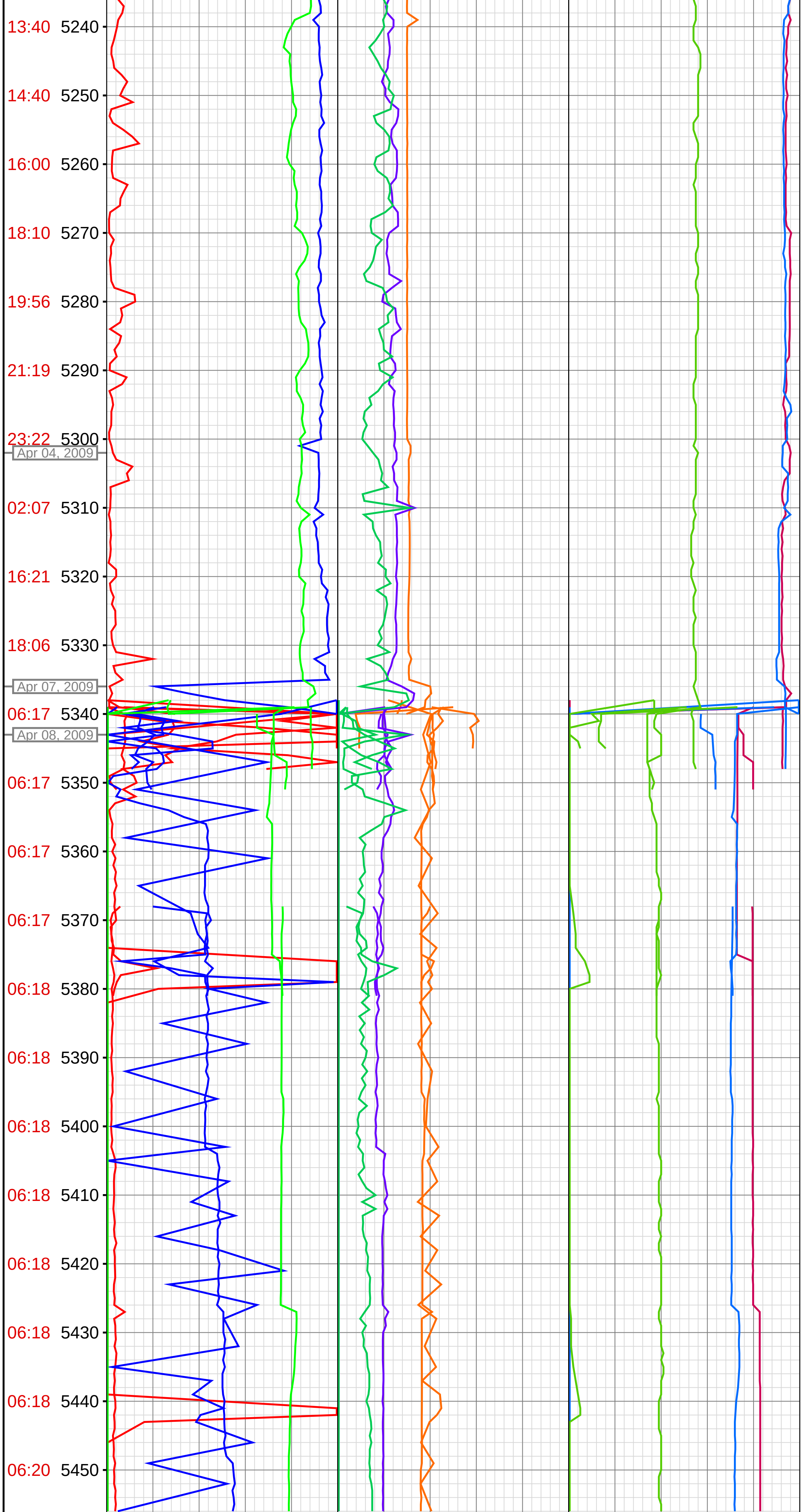
4566.01ft: REAM ONE JOINT AT A TIME.BREAK DOWN STANDS OUT OF DERRICK
4566.01ft: HOLE IS TIGHT /WORK TIGHT SPOTS
4566.01ft: PUMP PILL
4566.01ft: Lubricate rig
4566.01ft: EVENING OUT MUD PROPERTIES
4566.01ft: LEVELING
4566.01ft: ZWOB from SideKick sk-05-09-1342
4566.01ft: ZWOB from SideKick sk-05-09-1342
4566.01ft: FELL FREE AT APX 3600FT
4566.01ft: PUT KELLY ON/CIRC
4566.01ft: work pipe
4566.01ft: set kelly back trip in hole 1 stand off bottom
4566.01ft: put kelly on hole 3 stands off bottom tight spot ream
4566.01ft: ran half stand ibn pyut kelly on ream down
4566.01ft: RAN half stand in put kelly on ream down
4566.01ft: ran half a stand in put kelly on ream down
4566.01ft: weight 9.1 vis 48
4566.01ft: ran half stand in put kelly on ream
4566.01ft: picked up 20 feet circulate
4566.01ft: worked pipe
4566.01ft: lost circulation at 4550
4566.01ft: ream to bottom last 16 feet
4566.01ft: BIT DEPTH CHANGED TO 4566.0 FEET
4566.08ft: dry drill with 1 pump slow pump rate
4568.01ft: ZWOB from DHC
4568.01ft: ZDIFF from DHC
4568.11ft: pulled up circulate
4568.11ft: CLEAN OUT SAND TRAP/SHALE PIT
4568.11ft: BUILD VOLUME
4568.11ft: MIX PILL
4568.11ft: PUMP CEMNET PILL
4568.11ft: PULL 4 STANDS/WAIT ON MATERIAL
4568.11ft: RUN IN 4 STANDS
4568.11ft: mix LCM pill
4568.11ft: Pump LCM pill and pull 4 stands
4568.11ft: trip 4 stands in/put kelly on-rotate,build l.c.m. pill
4568.11ft: PUMP PILL
4568.11ft: PRESSURED UP/PLUG BIT/PULL10 STANDS
4568.11ft: UNPLUGGED BIT/BUILD VOLUME/STAGE IN HOLE
4568.11ft: LOST CIRC
4568.11ft: ATTEMP TO REGAIN CIRC
4568.11ft: TRIP OUT FOR CEMENT JOB
4568.11ft: SLIP AND CUT
4568.11ft: PICK UP DP
4568.11ft: RIG SERVICE
4568.11ft: TRIP IN HOLE OPEN ENDED
4568.11ft: put kelley on to circulate
4568.11ft: took 120 bbls for fluid to circulate
4568.11ft: tagged up 4559/put kelly on circulate-both pumps 115 s.p.m
4568.11ft: lost circulation/pulled 10 stands/wait on cement truck
4568.11ft: trip 15 stands circulate/build volume
4569.00ft: HOLE DEPTH CHANGED TO 4562.0 FEET
4569.06ft: Started drilling @ 14:45 started taking fluid slowed down
4569.06ft: pumps and start mixing a LCM pill
4569.06ft: pumps and started mixing LCM pill
4569.06ft: PUMP LCM PILL
4569.06ft: Pumped 40bbl LCM pill
4571.00ft: Pumped 2nd LCM pill begin drilling@ 4569'
4579.99ft: ZWOB from DHC
4587.01ft: ZWOB from DHC
4587.01ft: BIT DEPTH CHANGED TO 4568.0 FEET
4587.01ft: HOOKLOAD WAS RECALIBRATED
4587.01ft: HOOKLOAD WAS RECALIBRATED
4604.00ft: HOLE DEPTH CHANGED TO 4587.0 FEET
4610.99ft: ZWOB from SideKick sk-05-09-1342
4610.99ft: ZWOB from SideKick sk-05-09-1342
4611.09ft: CONN@4610
4611.35ft: conn 4613/weight 8 vis 35
4612.30ft: MUD WT 8.8
4612.99ft: MAX PULL LIMIT CHANGED FROM 449.6178 TO 343000.0
4612.99ft: MAX PULL LIMIT CHANGED FROM 342999.94 TO



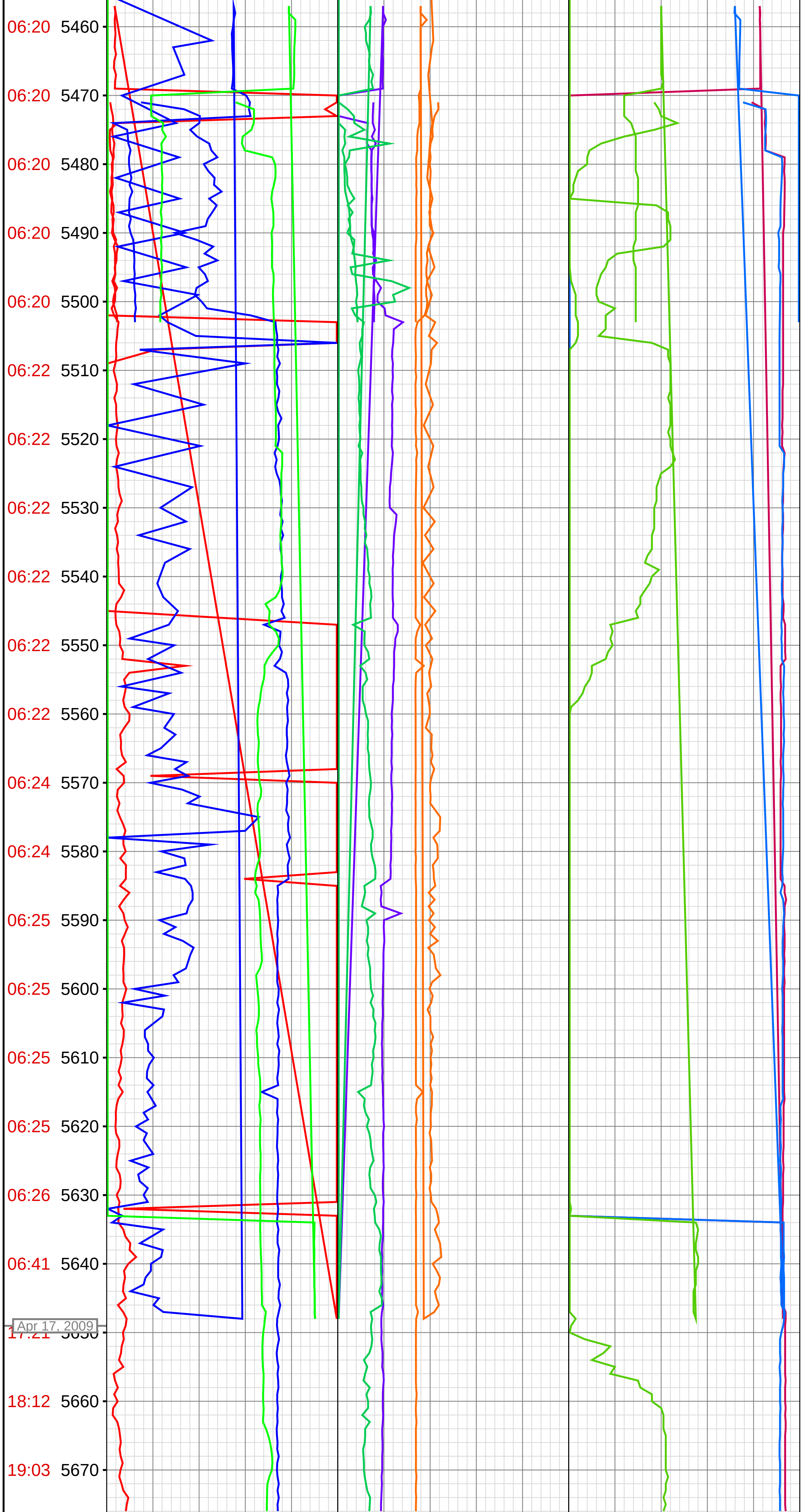
343.0
4613.19ft: 10 FT FILL ON CONN
4616.01ft: BIT DEPTH CHANGED TO 4477.12 FEET
4616.01ft: HOLE DEPTH CHANGED TO 4568.0 FEET
4616.01ft: ZWOB from SideKick sk-05-09-1342
4620.21ft: CLEAN BOTH PUMP SCREENS
4637.53ft: CHECKING PIT LEVELS
4641.70ft: ZWOB from SideKick sk-05-09-1342
4644.00ft: ZWOB from SideKick sk-05-09-1342
4644.19ft: 2424 gal fuel on rig
4644.92ft: KNOT AT 4607 - PIPE WILL STACK UP
4650.13ft: pumped 40 bbl pill
4675.98ft: HOOK LOAD HIGH RECALIBRATED
4675.98ft: ZWOB from SideKick sk-05-09-1342
4676.08ft: Lubricate rig
4676.08ft: Jet shale pit
4706.00ft: ZWOB from SideKick sk-05-09-1342
4720.24ft: Change head on #2 MP
4720.24ft: VIS 41 / WT. 8.8
4722.24ft: PUMPED VOLUME PILL INTO SYSTEM/APPRX.40BBL.
4726.41ft: ROTARY TRYING TO STALL
4737.99ft: ZWOB from SideKick sk-05-09-1342
4738.35ft: CONN @ 4739 / H.O.B. 14.2
4738.35ft: PUMPED VOLUME PILL INTO SYSTEM/APPRX. 40BBL.
4739.57ft: VIS.40 / WT. 8.9
4770.01ft: ZWOB from SideKick sk-05-09-1342
4770.54ft: CONN.@4770/H.O.B.17.0/JETTED SHALE PIT
4784.35ft: VIS. 38 / WT. 8.9+
4800.98ft: ZWOB from SideKick sk-05-09-1342
4801.05ft: CONN.@4801 / LUBRICATE RIG
4801.05ft: H.O.B. 19.7
4804.04ft: PUMPED VOLUME PILL INTO SYSTEM / APPRX. 40BBL.
4810.70ft: VIS 45 / WT. 8.9
4814.14ft: GO THRU #1 PUMP
4814.14ft: CLEAN SCREENS ON BOTH PUMPS
4816.01ft: ZWOB from SideKick sk-05-09-1342
4829.99ft: ZWOB from SideKick sk-05-09-1342
4833.01ft: ZWOB from SideKick sk-05-09-1342
4833.89ft: Lubricate rig
4837.30ft: Go thru # 2 MP
4837.30ft: CHECK VALVES/SPRINGS
4860.99ft: ZWOB from SideKick sk-05-09-1342
4863.25ft: Reset hole depth
4864.01ft: ZWOB from SideKick sk-05-09-1342
4878.05ft: Clean pit and unplug cross tubes
4878.05ft: Back to drilling
4882.81ft: pump volume pill
4888.75ft: pump volume pill
4891.99ft: ZWOB from SideKick sk-05-09-1342
4894.19ft: pump volume pill
4903.15ft: PUMP VOLUME PILL / 43bbl.+/-
4908.17ft: PUMPED VOLUME PILL / 40bbl. +/-
4909.06ft: VIS 48 / WT. 8.9
4924.02ft: ZWOB from SideKick sk-05-09-1342
4927.00ft: ZWOB from SideKick sk-05-09-1342
4927.03ft: CONN.@4927 /LUBRICATE RIG /JET SHALE PIT
4927.03ft: CLEAN SCREENS ON BOTH PUMPS / H.O.B. 34.5
4927.03ft: PUMP VOLUME PILL / 40bbl +/-
4947.47ft: VIS 51 / WT. 8.9
4954.99ft: ZWOB from SideKick sk-05-09-1342
4956.63ft: PUMP VOLUME PILL 40bbl. +/-
4958.01ft: ZWOB from SideKick sk-05-09-1342
4958.10ft: CONN.@4958 /JET SHALE PIT /H.O.B. 37.1
4961.94ft: PUMP VOLUME PILL / 40bbl.+/-
4966.40ft: PUMP VOLUME PILL /40bbl. +/-
4971.85ft: PUMPED VOLUME PILL / 40BBL. +/-
4986.48ft: service rig
4987.01ft: ZWOB from SideKick sk-05-09-1342



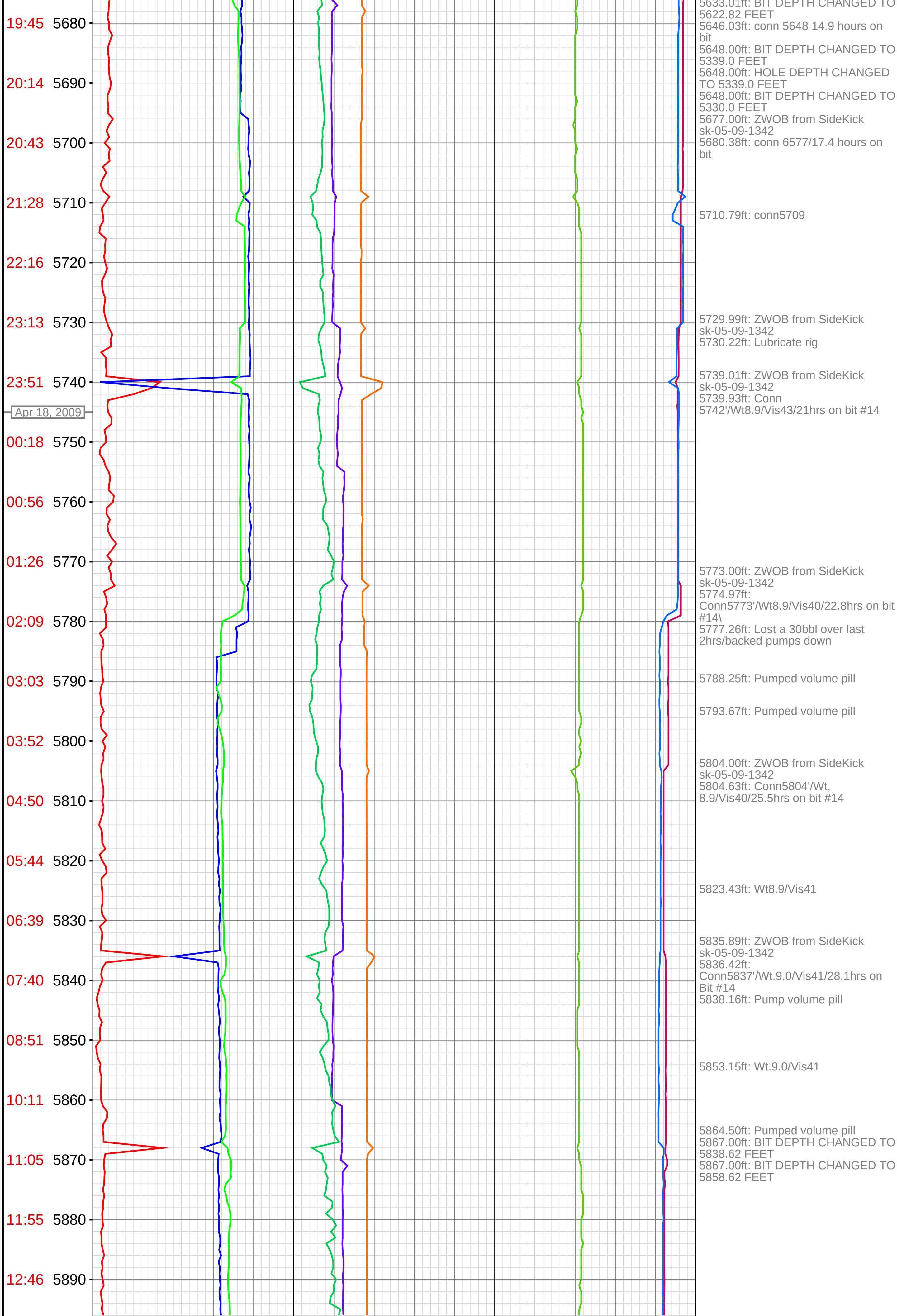
4987.96ft: lubricate rig
4987.96ft: manage pipe / lay down 6 joints out of derrick
4987.96ft: back to drilling cement
4989.01ft: ZWOB from SideKick sk-05-09-1342
4989.11ft: CONN.@4989/H.O.B.40.7/JET SHALE PIT
4990.22ft: PUMPED VOLUME PILL 40bbl.+/-
4993.67ft: PUMPED VOLUME PILL 40bbl. +/-
5017.68ft: Turn shakers back on
5021.33ft: pump volume pill
5021.33ft: Lubricate rig
5021.33ft: ZWOB from SideKick sk-05-09-1342
5029.20ft: 46 hrs on bit #10/Wt 9.0/Vis 66
5037.93ft: pump volume pill
5045.08ft: pumped LCM pill
5049.87ft: pump LCM pill\
5051.97ft: pump volume pill
5056.96ft: pump volume pill
5062.93ft: pump volume pill
5064.73ft: pump volume pill
5071.00ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5071.00ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5071.00ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5071.00ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5071.00ft: ZWOB from SideKick sk-05-09-1342
5071.29ft: RUN LOST CIRCULATION TEST
5072.93ft: PUMP VOLUME PILL
5074.34ft: PUMP VOLUME PILL
5077.62ft: VIS 51 / WT. 8.8+
5083.01ft: ZWOB from SideKick sk-05-09-1342
5083.92ft: CONN.@5083/LUBRICATE RIG/JET SHALE PIT/H.O.B.56.0
5083.92ft: PUMP VOLUME PILL
5083.92ft: CLEAN BOTH PUMP SCREENS
5085.01ft: BIT DEPTH CHANGED TO 5102.3 FEET
5085.89ft: PUMP VOLUME PILL
5087.17ft: PUMPED VOLUME PILL
5088.45ft: VIS 51 / WT.8.8+
5090.32ft: PUMPED VOLUME PILL
5094.26ft: PUMPED VOLUME PILL
5100.30ft: PUMP VOLUME PILL
5100.85ft: out of cement at 5092
5104.04ft: DIREGARD DEPTH
5114.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5114.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5114.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5114.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5114.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5114.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5114.01ft: ZWOB from SideKick sk-05-09-1342
5116.50ft: CONN.@5115/CLEAN BOTH PUMP SCREENS/H.O.B.61.7
5118.01ft: BIT DEPTH CHANGED TO 5070.87 FEET
5118.01ft: HOLE DEPTH CHANGED TO 5070.87 FEET
5120.01ft: BIT DEPTH CHANGED TO 1941.0 FEET
5120.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5120.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5120.01ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5120.01ft: BIT DEPTH CHANGED TO 4858.0 FEET
5120.01ft: BIT DEPTH CHANGED TO 943.0 FEET
5120.01ft: BIT DEPTH CHANGED TO 4411.41 FEET
5120.01ft: ZWOB from SideKick sk-05-09-1342
5120.01ft: ZWOB from SideKick sk-05-09-1342
5120.01ft: ZWOB from SideKick sk-05-09-1342
5120.01ft: ZWOB from SideKick sk-05-09-1342
5120.01ft: ZWOB from SideKick sk-05-09-1342
5120.01ft: HOLE DEPTH CHANGED TO 4575.3 FEET
5120.01ft: ZWOB from SideKick sk-05-09-1342
5120.11ft: pump out pill - pull 5 stnds - m&p slug
5120.11ft: SLUG PIPE
5120.11ft: pooh
5120.11ft: BIT DEPTH CHANGED TO

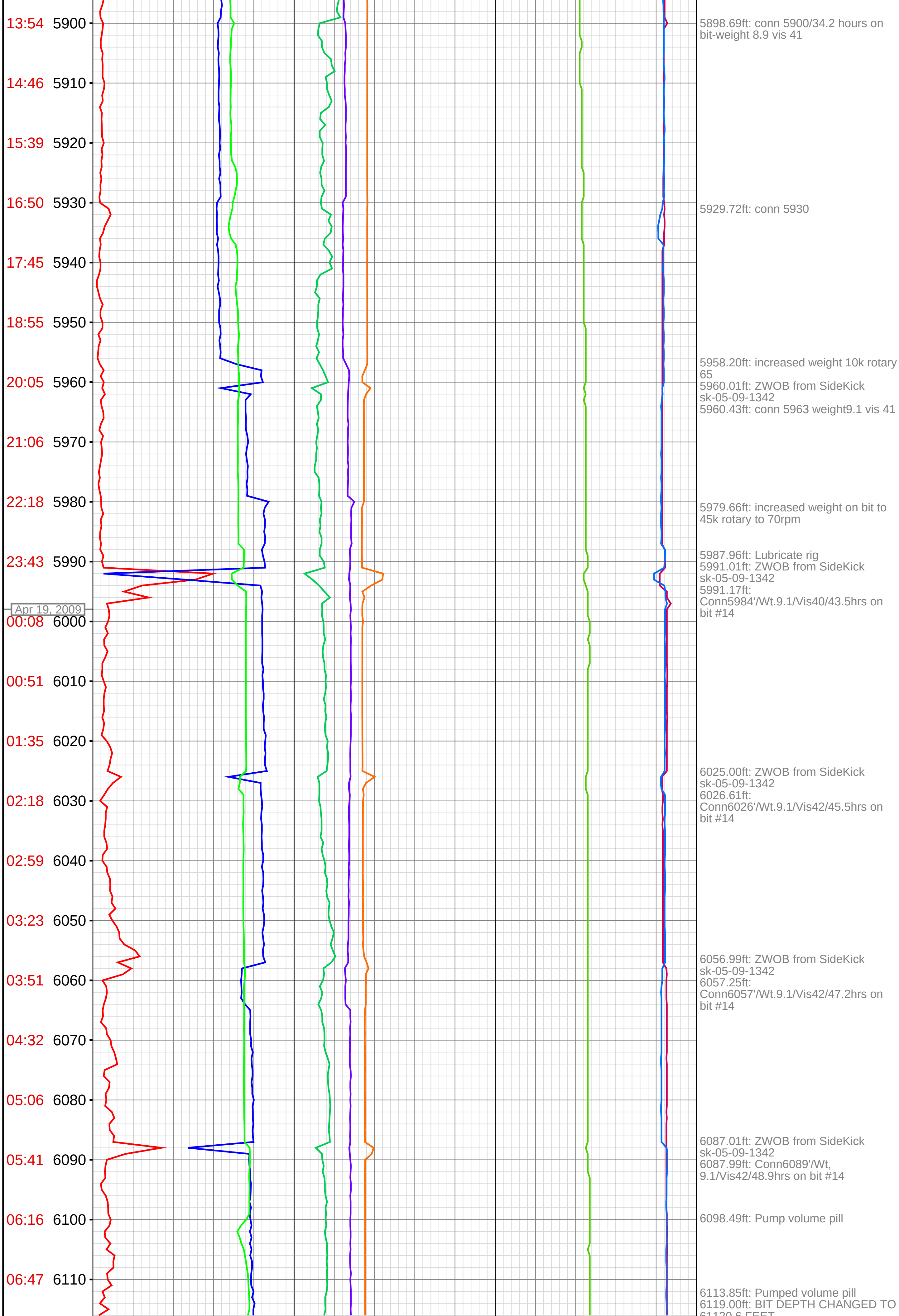


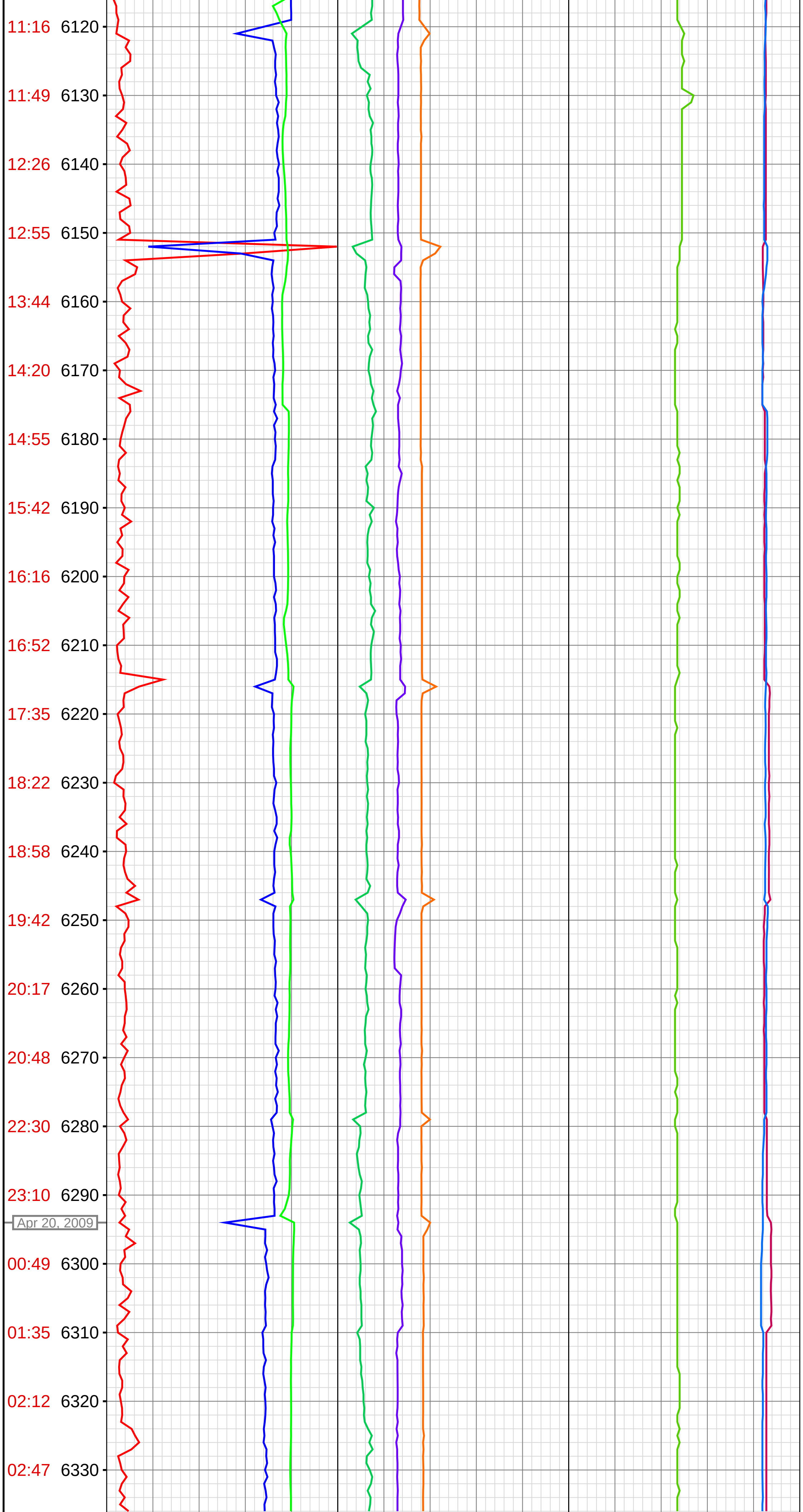
5120.0 FEET
5120.11ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5120.11ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
5120.11ft: PUMP VOLUME PILL
5120.11ft: fluid level static in annulus
5120.11ft: r/u and run survey
5120.11ft: Survey at 4800 - 1/4 degree
5120.11ft: working on pason
5120.11ft: CONN.@4515
5120.11ft: CONN@4547
5120.11ft: CONN@4578
5125.98ft: ZWOB from SideKick sk-05-09-1342
5126.08ft: stop drilling to change flag
5130.45ft: stop drilling for new flag
5140.16ft: fix rod oiler line
5162.01ft: ZWOB from SideKick sk-05-09-1342
5162.96ft: GO THRU #2 PUMP
5168.73ft: VIS. 51 / WT. 8.8
5173.95ft: ZWOB from SideKick sk-05-09-1342
5174.05ft: CONN@5175 / H.O.B.15.0
5186.78ft: VIS48 / WT.8.8
5204.99ft: ZWOB from SideKick sk-05-09-1342
5206.00ft: CONN@5206 / H.O.B.19.3
5224.38ft: Lubricate rig
5300.30ft: CONN@5301/LUBRICATE RIG/H.O.B.34.3
5300.30ft: GO THRU #2 PUMP & CLEAN BOTH PUMP SCREENS
5300.30ft: ZWOB from SideKick sk-05-09-1342
5309.97ft: REPLACE VALVES & SEATS OBS #2 PUMP
5310.99ft: ZWOB from SideKick sk-05-09-1342
5311.12ft: ZEROD GAIN/LOSS @ 0236am
5311.32ft: WORK ON #2 PUMP CLUTCH
5311.61ft: 8HRS. ESTIMATED DOWNTIME /PUMP REPAIRS
5314.99ft: Pump 40 bbl sweep
5317.06ft: Pump 40 bbl sweep
5331.00ft: ZWOB from SideKick sk-05-09-1342
5335.01ft: BIT DEPTH CHANGED TO 0.0 FEET
5335.01ft: ZWOB from SideKick sk-05-09-1342
5335.01ft: BIT DEPTH CHANGED TO 5320.0 FEET
5335.01ft: ZWOB from SideKick sk-05-09-1342
5335.01ft: ZWOB from SideKick sk-05-09-1342
5335.96ft: TD @ 5336 Casing point
5335.96ft: Pulled 50 bbl of mud from live to make pill
5335.96ft: Pump high vis sweep
5335.96ft: Pump high vis sweep
5335.96ft: DROP TOTCO / T.O.O.H. FOR LOGS
5335.96ft: SAFETY MTG. W/LOGGERS
5335.96ft: RIG UP LOGGERS
5335.96ft: PICK UP BIT/ T.I.H
5335.96ft: ZWOB from SideKick sk-05-09-1342
5337.73ft: VIS 55 / WT.9.1
5339.01ft: BIT DEPTH CHANGED TO 5332.0 FEET
5339.01ft: PUMPED SWEEP
5339.01ft: BIT DEPTH CHANGED TO 40.0 FEET
5339.01ft: ZWOB from DHC
5339.01ft: BIT DEPTH CHANGED TO 1680.0 FEET
5339.01ft: circulation at 12:15
5339.01ft: hook cement trucks on hole
5339.01ft: CEMENTING 1ST STAGE
5339.01ft: dropped bomb at 6:15
5339.01ft: cement noticed coming up hole @7:15
5339.01ft: cement still flowing out of hole
5339.01ft: start second stage of cement
5339.01ft: pick up pipe trip in hole
5339.01ft: BIT DEPTH CHANGED TO 2500.25 FEET
5339.01ft: lubricate rig
5339.01ft: build volume circulate hole
5339.01ft: TEST HYDRILL /550 PSI ON RIG GAUGE
5339.01ft: TEST PIPE RAMS / 1075 PSI RIG GAUGE
5339.01ft: test under DV tool @1100 psi on rig gauge
5339.01ft: test choke manifold @1100 psi
5339.01ft: test casing to 900psi
5339.01ft: Run a F.I.T. @ 875psi for 10min
5339.01ft: Lubricate rig
5339.01ft: BIT DEPTH CHANGED TO 5339.5 FEET
5339.07ft: PUMPED SWEEP



5339.07ft: ZEROD GAIN/LOSS
5339.07ft: FILLING PILL PIT
5339.17ft: 1 foot of fill
5342.36ft: circulate bottoms up
5345.01ft: HOLE DEPTH CHANGED TO 5339.0 FEET
5345.01ft: BIT DEPTH CHANGED TO 48.6 FEET
5345.01ft: BIT DEPTH CHANGED TO 2472.0 FEET
5345.01ft: BIT DEPTH CHANGED TO 3084.84 FEET
5345.01ft: ZWOB from SideKick sk-05-09-1342
5345.01ft: BIT DEPTH CHANGED TO 3670.49 FEET
5345.01ft: ZWOB from SideKick sk-05-09-1342
5345.01ft: HOOK LOAD HIGH RECALIBRATED
5345.01ft: BIT DEPTH CHANGED TO 5270.34 FEET
5345.01ft: ZWOB from SideKick sk-05-09-1342
5345.01ft: BIT DEPTH CHANGED TO 5301.76 FEET
5345.47ft: saftey meetting/nipple up b.o.p
5345.47ft: 2472gal on rig/238 gal used
5345.47ft: pressure test blind rams
5346.00ft: BIT DEPTH CHANGED TO 5317.0 FEET
5346.00ft: ZWOB from SideKick sk-05-09-1342
5348.00ft: HOLE DEPTH CHANGED TO 5339.0 FEET
5350.98ft: BIT DEPTH CHANGED TO 5291.64 FEET
5350.98ft: HOLE DEPTH CHANGED TO 5339.0 FEET
5350.98ft: STANDPIPE PRESSURE ZEROED
5350.98ft: ZWOB from DHC
5351.35ft: weight8.9 vis43
5353.54ft: conn5342
5375.49ft: conn 5375
5381.00ft: HOLE DEPTH CHANGED TO 5367.8 FEET
5381.50ft: BIT DEPTH CHANGED TO 5354.69 FEET
5395.01ft: ZWOB from SideKick sk-05-09-1342
5395.28ft: Conn @ 5396 / 11.3hrs on bit #12
5426.21ft: Lubricate rig
5426.21ft: Conn @ 5427' / 15.6 hrs on bit #12
5426.21ft: ZWOB from SideKick sk-05-09-1342
5457.22ft: conn 5459 19.2 hours on bit
5469.00ft: BIT DEPTH CHANGED TO 5162.2 FEET
5469.98ft: circulate clean hole for core
5473.00ft: ZWOB from SideKick sk-05-09-1342
5473.00ft: ZWOB from SideKick sk-05-09-1342
5473.39ft: Begin coring @ 5474'
5477.33ft: Wt8.9 / Vis40
5480.58ft: Wt.8.9/Vis 40
5484.74ft: REMOTE: please record vis and wt. every 2 hrs. on pason-----tvs
5488.81ft: Wt8.9 / Vis40
5489.01ft: HOOK LOAD HIGH RECALIBRATED
5489.01ft: ZWOB from SideKick sk-05-09-1342
5492.09ft: Conn @ 5490/Wt.8.9/Vis40/3.1hrs on bit # 14\
5502.99ft: BIT DEPTH CHANGED TO 0.0 FEET
5502.99ft: BIT DEPTH CHANGED TO 366.5 FEET
5502.99ft: BIT DEPTH CHANGED TO 5456.08 FEET
5502.99ft: BIT DEPTH CHANGED TO 5449.1 FEET
5503.90ft: T.O.O.H Core #1
5503.90ft: kelly on fill pipe
5503.90ft: run straight hole test 5456
5503.90ft: ZWOB from SideKick sk-05-09-1342
5503.90ft: HOLE DEPTH CHANGED TO 5470.4 FEET
5509.78ft: Wt.8.9/Vis40/5.4 hrs on bit #14
5521.29ft: Lubricate rig
5521.33ft: Conn @ 5542'/Wt.8.9/Vis40
5521.33ft: ZWOB from SideKick sk-05-09-1342
5539.01ft: pump volume pill
5552.00ft: ZWOB from SideKick sk-05-09-1342
5583.99ft: ZWOB from SideKick sk-05-09-1342
5584.25ft: conn 5585/10.9 hours on bit-weight 8.9vis40 lubricate rig
5615.58ft: conn 5615 hour on bit 12.7/weight vis 43


19:45 5680
20:14 5690
20:43 5700
21:28 5710
22:16 5720
23:13 5730
23:51 5740
Apr 18, 2009
00:18 5750
00:56 5760
01:26 5770
02:09 5780
03:03 5790
03:52 5800
04:50 5810
05:44 5820
06:39 5830
07:40 5840
08:51 5850
10:11 5860
11:05 5870
11:55 5880
12:46 5890
5633.01ft: BIT DEPTH CHANGED TO 5622.82 FEET
5646.03ft: conn 5648 14.9 hours on bit
5648.00ft: BIT DEPTH CHANGED TO 5339.0 FEET
5648.00ft: HOLE DEPTH CHANGED TO 5339.0 FEET
5648.00ft: BIT DEPTH CHANGED TO 5330.0 FEET
5677.00ft: ZWOB from SideKick sk-05-09-1342
5680.38ft: conn 6577/17.4 hours on bit
5710.79ft: conn5709
5729.99ft: ZWOB from SideKick sk-05-09-1342
5730.22ft: Lubricate rig
5739.01ft: ZWOB from SideKick sk-05-09-1342
5739.93ft: Conn
5742'/Wt8.9/Vis43/21hrs on bit #14
5773.00ft: ZWOB from SideKick sk-05-09-1342
5774.97ft: Conn5773'/Wt8.9/Vis40/22.8hrs on bit #14\
5777.26ft: Lost a 30bbl over last 2hrs/backed pumps down
5788.25ft: Pumped volume pill
5793.67ft: Pumped volume pill
5804.00ft: ZWOB from SideKick sk-05-09-1342
5804.63ft: Conn5804'/Wt, 8.9/Vis40/25.5hrs on bit #14
5823.43ft: Wt8.9/Vis41
5835.89ft: ZWOB from SideKick sk-05-09-1342
5836.42ft: Conn5837'/Wt.9.0/Vis41/28.1hrs on Bit #14
5838.16ft: Pump volume pill
5853.15ft: Wt.9.0/Vis41
5864.50ft: Pumped volume pill
5867.00ft: BIT DEPTH CHANGED TO 5838.62 FEET
5867.00ft: BIT DEPTH CHANGED TO 5858.62 FEET


13:54 5900
14:46 5910
15:39 5920
16:50 5930
17:45 5940
18:55 5950
20:05 5960
21:06 5970
22:18 5980
23:43 5990
Apr 19, 2009
00:08 6000
00:51 6010
01:35 6020
02:18 6030
02:59 6040
03:23 6050
03:51 6060
04:32 6070
05:06 6080
05:41 6090
06:16 6100
06:47 6110
5898.69ft: conn 5900/34.2 hours on bit-weight 8.9 vis 41
5929.72ft: conn 5930
5958.20ft: increased weight 10k rotary 65
5960.01ft: ZWOB from SideKick sk-05-09-1342
5960.43ft: conn 5963 weight9.1 vis 41
5979.66ft: increased weight on bit to 45k rotary to 70rpm
5987.96ft: Lubricate rig
5991.01ft: ZWOB from SideKick sk-05-09-1342
5991.17ft: Conn5984'/Wt.9.1/Vis40/43.5hrs on bit #14
6025.00ft: ZWOB from SideKick sk-05-09-1342
6026.61ft: Conn6026'/Wt.9.1/Vis42/45.5hrs on bit #14
6056.99ft: ZWOB from SideKick sk-05-09-1342
6057.25ft: Conn6057'/Wt.9.1/Vis42/47.2hrs on bit #14
6087.01ft: ZWOB from SideKick sk-05-09-1342
6087.99ft: Conn6089'/Wt. 9.1/Vis42/48.9hrs on bit #14
6098.49ft: Pump volume pill
6113.85ft: Pumped volume pill
6119.00ft: BIT DEPTH CHANGED TO



6119.00ft: HOLE DEPTH CHANGED TO 6120.6 FEET
6119.00ft: ZWOB from SideKick sk-05-09-1342
6119.00ft: ZWOB from SideKick sk-05-09-1342
6120.60ft: Circulate 1 hour pump slug pull out for short trip
6120.60ft: S.H.T. @ 6100' is 1/2 degree
6133.30ft: ZEROD GAIN/LOSS

6150.98ft: ZWOB from SideKick sk-05-09-1342
6151.08ft: CONN@6152/Lubricate rig/H.O.B.52.8

6183.01ft: CONN@6183/H.O.B.54.6
6183.01ft: ZWOB from SideKick sk-05-09-1342
6186.09ft: BLEEDING VOLUME PILL INTO SYSTEM SLOWLY

6204.86ft: VIS.42 / WT. 9.2

6214.99ft: ZWOB from SideKick sk-05-09-1342
6215.03ft: CONN@6215/H.O.B.56.7

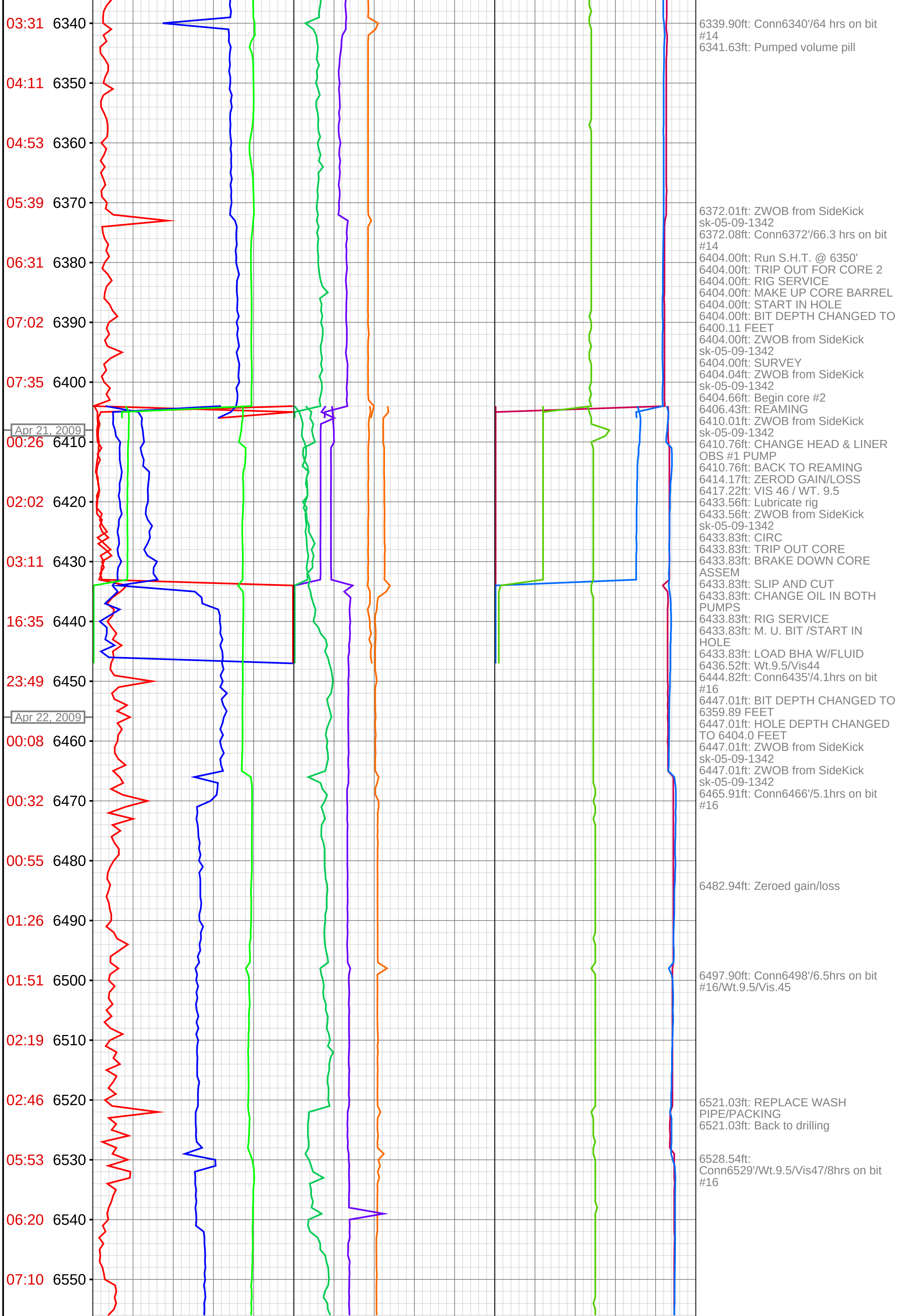
6233.37ft: VIS 40 / 9.2+

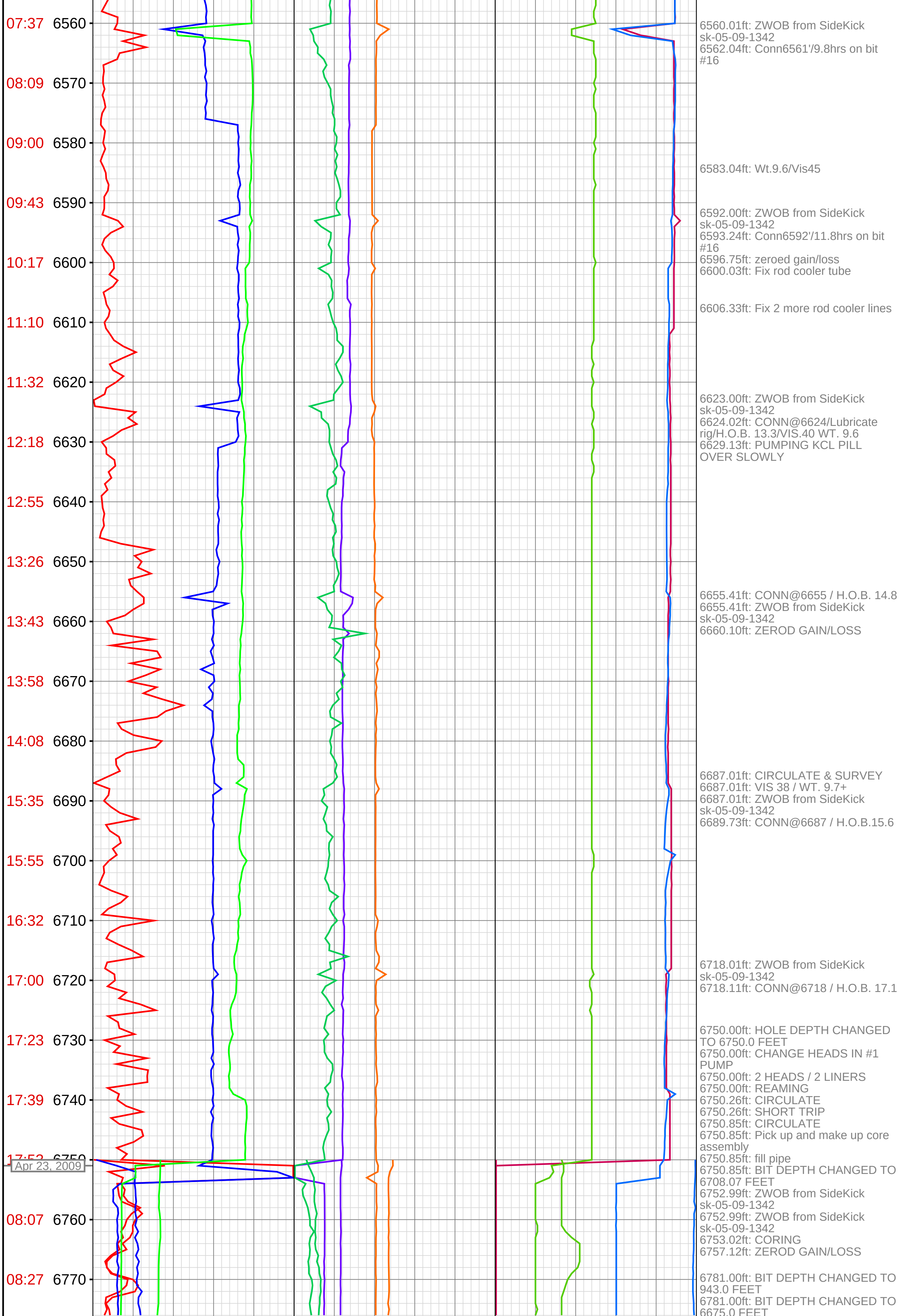
6246.00ft: ZWOB from SideKick sk-05-09-1342
6246.19ft: CONN@6246/H.O.B.58.6
6247.64ft: CLEAN BOTH PUMP SCREENS

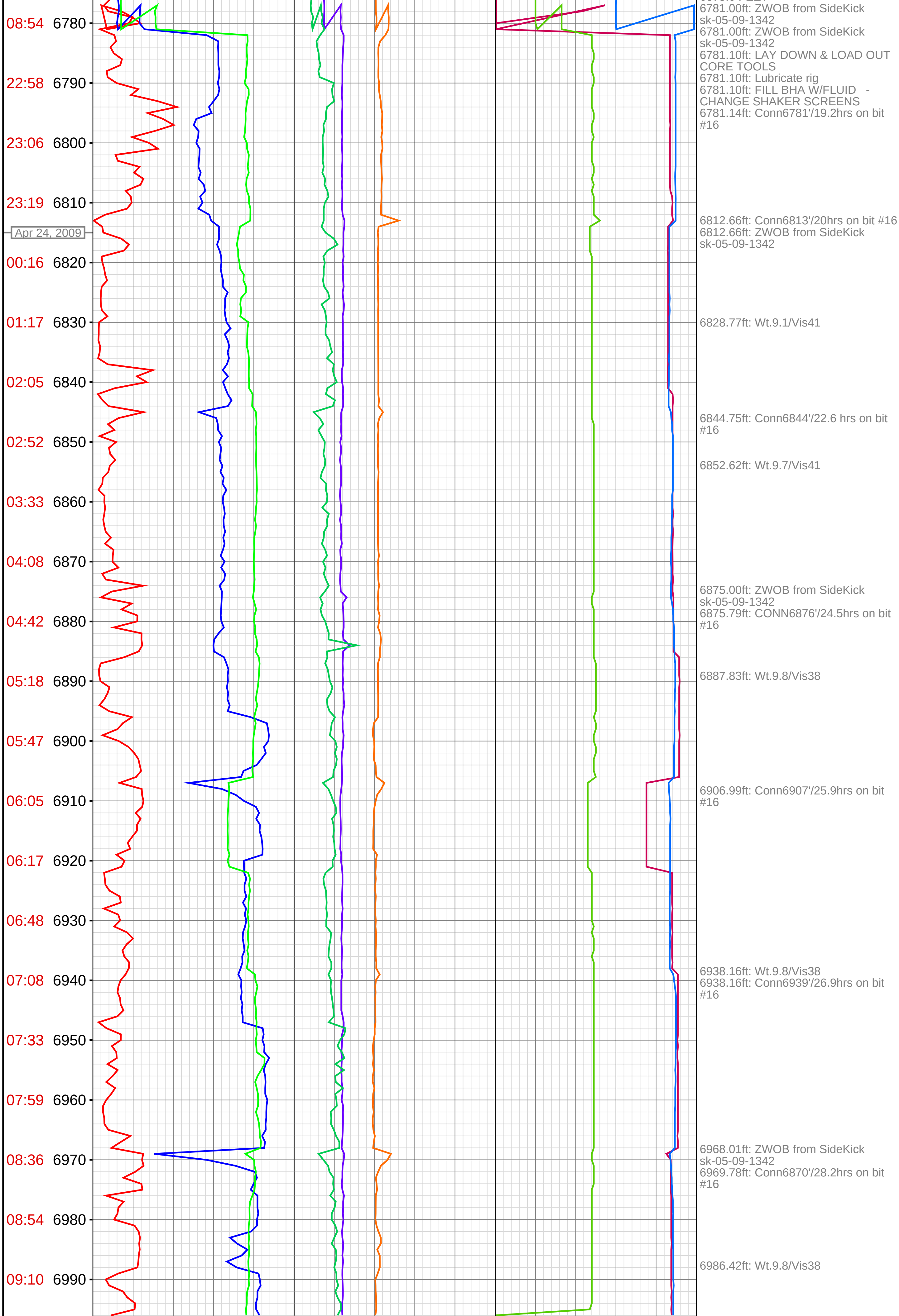
6277.99ft: ZWOB from SideKick sk-05-09-1342
6278.05ft: CHNGE HEAD IN #2 PUMP
6278.05ft: CHANGE LINER & DISCHARGE VALVE SEAT OBS #2 PUMP
6278.05ft: CONN@6278/H.O.B. 60.4

6292.36ft: Lubricate rig
6293.01ft: ZWOB from SideKick sk-05-09-1342
6293.83ft: Change valve and seat in #2 M.P.

6308.99ft: ZWOB from SideKick sk-05-09-1342
6309.91ft: Conn6309'/62.2hrs on bit#14


03:31 6340
04:11 6350
04:53 6360
05:39 6370
06:31 6380
07:02 6390
07:35 6400
Apr 21, 2009
00:26 6410
02:02 6420
03:11 6430
16:35 6440
23:49 6450
Apr 22, 2009
00:08 6460
00:32 6470
00:55 6480
01:26 6490
01:51 6500
02:19 6510
02:46 6520
05:53 6530
06:20 6540
07:10 6550
6339.90ft: Conn6340'/64 hrs on bit #14
6341.63ft: Pumped volume pill
6372.01ft: ZWOB from SideKick sk-05-09-1342
6372.08ft: Conn6372'/66.3 hrs on bit #14
6404.00ft: Run S.H.T. @ 6350'
6404.00ft: TRIP OUT FOR CORE 2
6404.00ft: RIG SERVICE
6404.00ft: MAKE UP CORE BARREL
6404.00ft: START IN HOLE
6404.00ft: BIT DEPTH CHANGED TO 6400.11 FEET
6404.00ft: ZWOB from SideKick sk-05-09-1342
6404.00ft: SURVEY
6404.04ft: ZWOB from SideKick sk-05-09-1342
6404.66ft: Begin core #2
6406.43ft: REAMING
6410.01ft: ZWOB from SideKick sk-05-09-1342
6410.76ft: CHANGE HEAD & LINER OBS #1 PUMP
6410.76ft: BACK TO REAMING
6414.17ft: ZEROD GAIN/LOSS
6417.22ft: VIS 46 / WT. 9.5
6433.56ft: Lubricate rig
6433.56ft: ZWOB from SideKick sk-05-09-1342
6433.83ft: CIRC
6433.83ft: TRIP OUT CORE
6433.83ft: BRAKE DOWN CORE ASSEM
6433.83ft: SLIP AND CUT
6433.83ft: CHANGE OIL IN BOTH PUMPS
6433.83ft: RIG SERVICE
6433.83ft: M. U. BIT /START IN HOLE
6433.83ft: LOAD BHA W/FLUID
6436.52ft: Wt.9.5/Vis44
6444.82ft: Conn6435'/4.1hrs on bit #16
6447.01ft: BIT DEPTH CHANGED TO 6359.89 FEET
6447.01ft: HOLE DEPTH CHANGED TO 6404.0 FEET
6447.01ft: ZWOB from SideKick sk-05-09-1342
6447.01ft: ZWOB from SideKick sk-05-09-1342
6465.91ft: Conn6466'/5.1hrs on bit #16
6482.94ft: Zeroed gain/loss
6497.90ft: Conn6498'/6.5hrs on bit #16/Wt.9.5/Vis.45
6521.03ft: REPLACE WASH PIPE/PACKING
6521.03ft: Back to drilling
6528.54ft: Conn6529'/Wt.9.5/Vis47/8hrs on bit #16


07:37 6560
08:09 6570
09:00 6580
09:43 6590
10:17 6600
11:10 6610
11:32 6620
12:18 6630
12:55 6640
13:26 6650
13:43 6660
13:58 6670
14:08 6680
15:35 6690
15:55 6700
16:32 6710
17:00 6720
17:23 6730
17:39 6740
17:52 6750
Apr 23, 2009
08:07 6760
08:27 6770
6560.01ft: ZWOB from SideKick sk-05-09-1342
6562.04ft: Conn6561'/9.8hrs on bit #16
6583.04ft: Wt.9.6/Vis45
6592.00ft: ZWOB from SideKick sk-05-09-1342
6593.24ft: Conn6592'/11.8hrs on bit #16
6596.75ft: zeroed gain/loss
6600.03ft: Fix rod cooler tube
6606.33ft: Fix 2 more rod cooler lines
6623.00ft: ZWOB from SideKick sk-05-09-1342
6624.02ft: CONN@6624/Lubricate rig/H.O.B. 13.3/VIS.40 WT. 9.6
6629.13ft: PUMPING KCL PILL OVER SLOWLY
6655.41ft: CONN@6655 / H.O.B. 14.8
6655.41ft: ZWOB from SideKick sk-05-09-1342
6660.10ft: ZEROD GAIN/LOSS
6687.01ft: CIRCULATE & SURVEY
6687.01ft: VIS 38 / WT. 9.7+
6687.01ft: ZWOB from SideKick sk-05-09-1342
6689.73ft: CONN@6687 / H.O.B.15.6
6718.01ft: ZWOB from SideKick sk-05-09-1342
6718.11ft: CONN@6718 / H.O.B. 17.1
6750.00ft: HOLE DEPTH CHANGED TO 6750.0 FEET
6750.00ft: CHANGE HEADS IN #1 PUMP
6750.00ft: 2 HEADS / 2 LINERS
6750.00ft: REAMING
6750.26ft: CIRCULATE
6750.26ft: SHORT TRIP
6750.85ft: CIRCULATE
6750.85ft: Pick up and make up core assembly
6750.85ft: fill pipe
6750.85ft: BIT DEPTH CHANGED TO 6708.07 FEET
6752.99ft: ZWOB from SideKick sk-05-09-1342
6752.99ft: ZWOB from SideKick sk-05-09-1342
6753.02ft: CORING
6757.12ft: ZEROD GAIN/LOSS
6781.00ft: BIT DEPTH CHANGED TO 943.0 FEET
6781.00ft: BIT DEPTH CHANGED TO 6675.0 FEET


08:54 6780
22:58 6790
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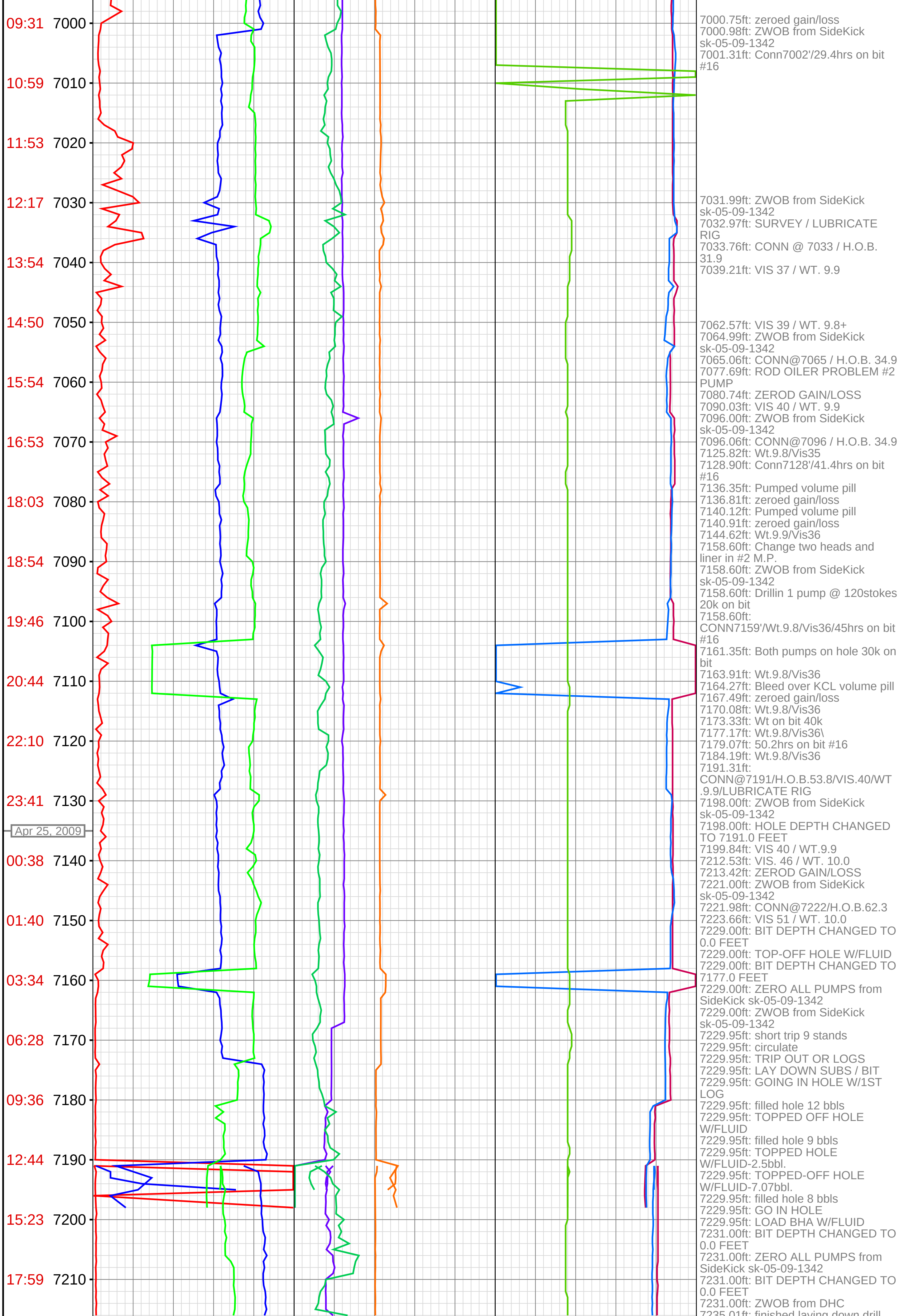
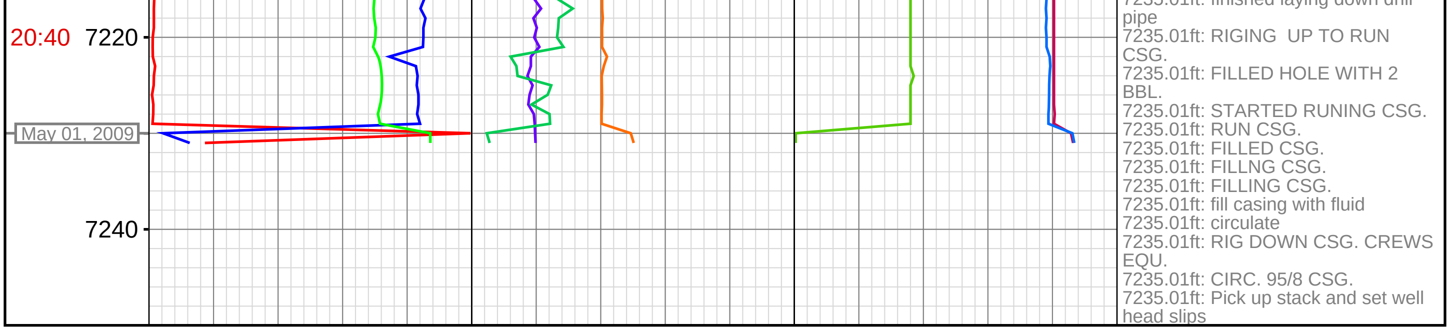
23:19 6810
Apr 24, 2009
00:16 6820
01:17 6830
02:05 6840
02:52 6850
03:33 6860
04:08 6870
04:42 6880
05:18 6890
05:47 6900
06:05 6910
06:17 6920
06:48 6930
07:08 6940
07:33 6950
07:59 6960
08:36 6970
08:54 6980
09:10 6990
6781.00ft: ZWOB from SideKick sk-05-09-1342
6781.00ft: ZWOB from SideKick sk-05-09-1342
6781.10ft: LAY DOWN & LOAD OUT CORE TOOLS
6781.10ft: Lubricate rig
6781.10ft: FILL BHA W/FLUID - CHANGE SHAKER SCREENS
6781.14ft: Conn6781'/19.2hrs on bit #16
6812.66ft: Conn6813'/20hrs on bit #16
6812.66ft: ZWOB from SideKick sk-05-09-1342
6828.77ft: Wt.9.1/Vis41
6844.75ft: Conn6844'/22.6 hrs on bit #16
6852.62ft: Wt.9.7/Vis41
6875.00ft: ZWOB from SideKick sk-05-09-1342
6875.79ft: CONN6876'/24.5hrs on bit #16
6887.83ft: Wt.9.8/Vis38
6906.99ft: Conn6907'/25.9hrs on bit #16
6938.16ft: Wt.9.8/Vis38
6938.16ft: Conn6939'/26.9hrs on bit #16
6968.01ft: ZWOB from SideKick sk-05-09-1342
6969.78ft: Conn6870'/28.2hrs on bit #16
6986.42ft: Wt.9.8/Vis38



09:31 7000
10:59 7010
11:53 7020
12:17 7030
13:54 7040
14:50 7050
15:54 7060
16:53 7070
18:03 7080
18:54 7090
19:46 7100
20:44 7110
22:10 7120
23:41 7130
Apr 25, 2009
00:38 7140
01:40 7150
03:34 7160
06:28 7170
09:36 7180
12:44 7190
15:23 7200
17:59 7210
7000.75ft: zeroed gain/loss
7000.98ft: ZWOB from SideKick sk-05-09-1342
7001.31ft: Conn7002'/29.4hrs on bit #16
7031.99ft: ZWOB from SideKick sk-05-09-1342
7032.97ft: SURVEY / LUBRICATE RIG
7033.76ft: CONN @ 7033 / H.O.B. 31.9
7039.21ft: VIS 37 / WT. 9.9
7062.57ft: VIS 39 / WT. 9.8+
7064.99ft: ZWOB from SideKick sk-05-09-1342
7065.06ft: CONN@7065 / H.O.B. 34.9
7077.69ft: ROD OILER PROBLEM #2 PUMP
7080.74ft: ZEROD GAIN/LOSS
7090.03ft: VIS 40 / WT. 9.9
7096.00ft: ZWOB from SideKick sk-05-09-1342
7096.06ft: CONN@7096 / H.O.B. 34.9
7125.82ft: Wt.9.8/Vis35
7128.90ft: Conn7128'/41.4hrs on bit #16
7136.35ft: Pumped volume pill
7136.81ft: zeroed gain/loss
7140.12ft: Pumped volume pill
7140.91ft: zeroed gain/loss
7144.62ft: Wt.9.9/Vis36
7158.60ft: Change two heads and liner in #2 M.P.
7158.60ft: ZWOB from SideKick sk-05-09-1342
7158.60ft: Drillin 1 pump @ 120stokes 20k on bit
7158.60ft: CONN7159'/Wt.9.8/Vis36/45hrs on bit #16
7161.35ft: Both pumps on hole 30k on bit
7163.91ft: Wt.9.8/Vis36
7164.27ft: Bleed over KCL volume pill
7167.49ft: zeroed gain/loss
7170.08ft: Wt.9.8/Vis36
7173.33ft: Wt on bit 40k
7177.17ft: Wt.9.8/Vis36\
7179.07ft: 50.2hrs on bit #16
7184.19ft: Wt.9.8/Vis36
7191.31ft: CONN@7191/H.O.B.53.8/VIS.40/WT .9.9/LUBRICATE RIG
7198.00ft: ZWOB from SideKick sk-05-09-1342
7198.00ft: HOLE DEPTH CHANGED TO 7191.0 FEET
7199.84ft: VIS 40 / WT.9.9
7212.53ft: VIS. 46 / WT. 10.0
7213.42ft: ZEROD GAIN/LOSS
7221.00ft: ZWOB from SideKick sk-05-09-1342
7221.98ft: CONN@7222/H.O.B.62.3
7223.66ft: VIS 51 / WT. 10.0
7229.00ft: BIT DEPTH CHANGED TO 0.0 FEET
7229.00ft: TOP-OFF HOLE W/FLUID
7229.00ft: BIT DEPTH CHANGED TO 7177.0 FEET
7229.00ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
7229.00ft: ZWOB from SideKick sk-05-09-1342
7229.95ft: short trip 9 stands
7229.95ft: circulate
7229.95ft: TRIP OUT OR LOGS
7229.95ft: LAY DOWN SUBS / BIT
7229.95ft: GOING IN HOLE W/1ST LOG
7229.95ft: filled hole 12 bbls
7229.95ft: TOPPED OFF HOLE W/FLUID
7229.95ft: filled hole 9 bbls
7229.95ft: TOPPED HOLE W/FLUID-2.5bbl.
7229.95ft: TOPPED-OFF HOLE W/FLUID-7.07bbl.
7229.95ft: filled hole 8 bbls
7229.95ft: GO IN HOLE
7229.95ft: LOAD BHA W/FLUID
7231.00ft: BIT DEPTH CHANGED TO 0.0 FEET
7231.00ft: ZERO ALL PUMPS from SideKick sk-05-09-1342
7231.00ft: BIT DEPTH CHANGED TO 0.0 FEET
7231.00ft: ZWOB from DHC
7235.01ft: finished laying down drill



20:40
7220
May 01, 2009
7240
7235.01ft: finished laying down drill pipe
7235.01ft: RIGING UP TO RUN CSG.
7235.01ft: FILLED HOLE WITH 2 BBL.
7235.01ft: STARTED RUNING CSG.
7235.01ft: RUN CSG.
7235.01ft: FILLED CSG.
7235.01ft: FILLNG CSG.
7235.01ft: FILLING CSG.
7235.01ft: fill casing with fluid
7235.01ft: circulate
7235.01ft: RIG DOWN CSG. CREWS EQU.
7235.01ft: CIRC. 95/8 CSG.
7235.01ft: Pick up stack and set well head slips

Appendix XI – Tallies of Installed Casing Strings

ADM CCS WELL #1: Surface Casing Tally

Total Depth Tagged (ft): 355.00

Joint #	Joint Length (ft)	Top Depth (ft)	Bottom Depth (ft)	Grade	Weight (lbs/ft)	Thread
1	44.88	310.12	355.00	H-40	94	8-round, STC
2	40.25	269.87	310.12	H-40	94	8-round, STC
3	41.67	228.20	269.87	H-40	94	8-round, STC
4	41.80	186.40	228.20	H-40	94	8-round, STC
5	41.56	144.84	186.40	H-40	94	8-round, STC
6	42.26	102.58	144.84	H-40	94	8-round, STC
7	42.97	59.61	102.58	H-40	94	8-round, STC
8	39.95	19.66	59.61	H-40	94	8-round, STC
9	40.74	-21.08	19.66	H-40	94	8-round, STC

ADM CCS WELL #1: Intermediate Casing Tally

Prepared by: PTH Jr/TG

Total Depth Tagged (ft): **5330** EST TD

Jt #	**Length**	Total	Top	Bottom	Grade	Wt	Thread	Cent.
Shoe	1.92	1.92	5328.08	5330.00				
1	**38.46**	40.38	5289.62	5328.08	J55	66.17	Butt	X
FC	**1.33**	41.71	5288.29	5289.62				
2	**47.82**	89.53	5240.47	5288.29	J55	66.17	Butt	X
3	**46.85**	136.38	5193.62	5240.47	J55	66.17	Butt	X
4	**46.82**	183.20	5146.80	5193.62	J55	66.17	Butt	X
5	**46.93**	230.13	5099.87	5146.80	J55	66.17	Butt	
6	**46.30**	276.43	5053.57	5099.87	J55	66.17	Butt	
7	**42.18**	318.61	5011.39	5053.57	J55	66.17	Butt	
8	**46.71**	365.32	4964.68	5011.39	J55	66.17	Butt	
9	**43.10**	408.42	4921.58	4964.68	J55	66.17	Butt	
10	**42.05**	450.47	4879.53	4921.58	J55	66.17	Butt	
11	**46.69**	497.16	4832.84	4879.53	J55	66.17	Butt	
12	**42.00**	539.16	4790.84	4832.84	J55	66.17	Butt	
13	**41.41**	580.57	4749.43	4790.84	J55	66.17	Butt	
14	**44.83**	625.40	4704.60	4749.43	J55	66.17	Butt	
15	**46.52**	671.92	4658.08	4704.60	J55	66.17	Butt	
16	**41.48**	713.40	4616.60	4658.08	J55	66.17	Butt	
17	**37.61**	751.01	4578.99	4616.60	J55	66.17	Butt	
18	**40.33**	791.34	4538.66	4578.99	J55	66.17	Butt	
19	**46.03**	837.37	4492.63	4538.66	J55	66.17	Butt	
20	**44.45**	881.82	4448.18	4492.63	J55	66.17	Butt	
21	**46.98**	928.80	4401.20	4448.18	J55	66.17	Butt	
22	**46.73**	975.53	4354.47	4401.20	J55	66.17	Butt	
23	**42.68**	1018.21	4311.79	4354.47	J55	66.17	Butt	
24	**45.63**	1063.84	4266.16	4311.79	J55	66.17	Butt	
25	**46.83**	1110.67	4219.33	4266.16	J55	66.17	Butt	
26	**43.18**	1153.85	4176.15	4219.33	J55	66.17	Butt	
27	**46.61**	1200.46	4129.54	4176.15	J55	66.17	Butt	
28	**46.96**	1247.42	4082.58	4129.54	J55	66.17	Butt	
29	**47.18**	1294.60	4035.40	4082.58	J55	66.17	Butt	
30	**46.09**	1340.69	3989.31	4035.40	J55	66.17	Butt	

ADM CCS WELL #1: Intermediate Casing Tally

** Stage tool 2.29' bottom of jt 37

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
31	**46.78**	1387.47	3942.53	3989.31	J55	66.17	Butt	
32	**45.32**	1432.79	3897.21	3942.53	J55	66.17	Butt	X
33	**44.79**	1477.58	3852.42	3897.21	J55	66.17	Butt	
34	**46.63**	1524.21	3805.79	3852.42	J55	66.17	Butt	X
35	**46.77**	1570.98	3759.02	3805.79	J55	66.17	Butt	
36	**41.18**	1612.16	3717.84	3759.02	J55	66.17	Butt	X
37	**44.63**	1656.79	3673.21	3717.84	J55	66.17	Butt	**
38	**42.58**	1699.37	3630.63	3673.21	J55	66.17	Butt	
39	**44.78**	1744.15	3585.85	3630.63	J55	59.50	Butt	
40	**41.82**	1785.97	3544.03	3585.85	J55	59.50	Butt	Bskt
41	**44.75**	1830.72	3499.28	3544.03	J55	59.50	Butt	
42	**43.78**	1874.50	3455.50	3499.28	J55	59.50	Butt	
43	**43.00**	1917.50	3412.50	3455.50	J55	59.50	Butt	
44	**43.95**	1961.45	3368.55	3412.50	J55	59.50	Butt	
45	**40.14**	2001.59	3328.41	3368.55	J55	59.50	Butt	
46	**44.19**	2045.78	3284.22	3328.41	J55	59.50	Butt	
47	**41.00**	2086.78	3243.22	3284.22	J55	59.50	Butt	
48	**44.68**	2131.46	3198.54	3243.22	J55	59.50	Butt	
49	**44.78**	2176.24	3153.76	3198.54	J55	59.50	Butt	
50	**41.50**	2217.74	3112.26	3153.76	J55	59.50	Butt	
51	**41.56**	2259.30	3070.70	3112.26	J55	59.50	Butt	
52	**44.23**	2303.53	3026.47	3070.70	J55	59.50	Butt	
53	**41.01**	2344.54	2985.46	3026.47	J55	59.50	Butt	
54	**44.73**	2389.27	2940.73	2985.46	J55	59.50	Butt	
55	**40.95**	2430.22	2899.78	2940.73	J55	59.50	Butt	
56	**40.60**	2470.82	2859.18	2899.78	J55	59.50	Butt	
57	**40.22**	2511.04	2818.96	2859.18	J55	59.50	Butt	
58	**41.40**	2552.44	2777.56	2818.96	J55	59.50	Butt	
59	**44.72**	2597.16	2732.84	2777.56	J55	59.50	Butt	
60	**41.48**	2638.64	2691.36	2732.84	J55	59.50	Butt	

ADM CCS WELL #1: Intermediate Casing Tally

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
61	**43.10**	2681.74	2648.26	2691.36	J55	59.50	Butt	
62	**40.94**	2722.68	2607.32	2648.26	J55	59.50	Butt	X
63	**41.03**	2763.71	2566.29	2607.32	J55	59.50	Butt	
64	**44.90**	2808.61	2521.39	2566.29	J55	59.50	Butt	
65	**44.16**	2852.77	2477.23	2521.39	J55	59.50	Butt	X
66	**40.68**	2893.45	2436.55	2477.23	J55	59.50	Butt	
67	**40.94**	2934.39	2395.61	2436.55	J55	59.50	Butt	
68	**40.63**	2975.02	2354.98	2395.61	J55	59.50	Butt	X
69	**44.66**	3019.68	2310.32	2354.98	J55	59.50	Butt	
70	**43.22**	3062.90	2267.10	2310.32	J55	59.50	Butt	
71	**40.80**	3103.70	2226.30	2267.10	J55	59.50	Butt	
72	**43.96**	3147.66	2182.34	2226.30	J55	59.50	Butt	
73	**41.68**	3189.34	2140.66	2182.34	J55	59.50	Butt	
74	**41.14**	3230.48	2099.52	2140.66	J55	59.50	Butt	
75	**44.21**	3274.69	2055.31	2099.52	J55	59.50	Butt	
76	**41.31**	3316.00	2014.00	2055.31	J55	59.50	Butt	
77	**44.34**	3360.34	1969.66	2014.00	J55	59.50	Butt	
78	**44.10**	3404.44	1925.56	1969.66	J55	59.50	Butt	
79	**44.27**	3448.71	1881.29	1925.56	J55	59.50	Butt	
80	**43.80**	3492.51	1837.49	1881.29	J55	59.50	Butt	
81	**44.32**	3536.83	1793.17	1837.49	J55	59.50	Butt	
82	**44.28**	3581.11	1748.89	1793.17	J55	59.50	Butt	
83	**42.91**	3624.02	1705.98	1748.89	J55	59.50	Butt	
84	**40.30**	3664.32	1665.68	1705.98	J55	59.50	Butt	
85	**41.08**	3705.40	1624.60	1665.68	J55	59.50	Butt	
86	**42.08**	3747.48	1582.52	1624.60	J55	59.50	Butt	
87	**41.20**	3788.68	1541.32	1582.52	J55	59.50	Butt	
88	**43.36**	3832.04	1497.96	1541.32	J55	59.50	Butt	
89	**44.78**	3876.82	1453.18	1497.96	J55	59.50	Butt	
90	**44.72**	3921.54	1408.46	1453.18	J55	59.50	Butt	

ADM CCS WELL #1: Intermediate Casing Tally

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
91	**44.00**	3965.54	1364.46	1408.46	J55	59.50	Butt	
92	**41.13**	4006.67	1323.33	1364.46	J55	59.50	Butt	
93	**39.95**	4046.62	1283.38	1323.33	J55	59.50	Butt	
94	**41.20**	4087.82	1242.18	1283.38	J55	59.50	Butt	
95	**41.58**	4129.40	1200.60	1242.18	J55	59.50	Butt	
96	**43.56**	4172.96	1157.04	1200.60	J55	59.50	Butt	
97	**44.68**	4217.64	1112.36	1157.04	J55	59.50	Butt	
98	**44.68**	4262.32	1067.68	1112.36	J55	59.50	Butt	
99	**41.26**	4303.58	1026.42	1067.68	J55	59.50	Butt	
100	**41.27**	4344.85	985.15	1026.42	J55	59.50	Butt	
101	**44.68**	4389.53	940.47	985.15	J55	59.50	Butt	
102	**44.68**	4434.21	895.79	940.47	J55	59.50	Butt	
103	**43.91**	4478.12	851.88	895.79	J55	59.50	Butt	
104	**42.90**	4521.02	808.98	851.88	J55	59.50	Butt	
105	**41.54**	4562.56	767.44	808.98	J55	59.50	Butt	
106	**44.60**	4607.16	722.84	767.44	J55	59.50	Butt	
107	**44.43**	4651.59	678.41	722.84	J55	59.50	Butt	
108	**38.85**	4690.44	639.56	678.41	J55	59.50	Butt	
109	**44.45**	4734.89	595.11	639.56	J55	59.50	Butt	
110	**40.30**	4775.19	554.81	595.11	J55	59.50	Butt	
111	**44.70**	4819.89	510.11	554.81	J55	59.50	Butt	
112	**44.80**	4864.69	465.31	510.11	J55	59.50	Butt	
113	**42.86**	4907.55	422.45	465.31	J55	59.50	Butt	
114	**41.27**	4948.82	381.18	422.45	J55	59.50	Butt	
115	**43.48**	4992.30	337.70	381.18	J55	59.50	Butt	
116	**41.25**	5033.55	296.45	337.70	J55	59.50	Butt	
117	**41.26**	5074.81	255.19	296.45	J55	59.50	Butt	
118	**44.70**	5119.51	210.49	255.19	J55	59.50	Butt	
119	**44.67**	5164.18	165.82	210.49	J55	59.50	Butt	
120	**41.08**	5205.26	124.74	165.82	J55	59.50	Butt	

ADM CCS WELL #1: Intermediate Casing Tally

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
121	**44.16**	5249.42	80.58	124.74	J55	59.50	Butt	
122	**43.99**	5293.41	36.59	80.58	J56	59.50	Butt	
123	**41.63**	5335.04	-5.04	36.59	J57	59.50	Butt	X
124	**41.25**	5376.29	-46.29	-5.04	J58	59.50	Butt	
125	**43.98**	5420.27	-90.27	-46.29	J59	59.50	Butt	X
126	**41.61**	5461.88	-131.88	-90.27	J60	59.50	Butt	
127	**43.34**	5505.22	-175.22	-131.88	J61	59.50	Butt	
128								
129								
130								
131								
132								
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150								

ADM CCS WELL #1: Final Casing Tally

Prepared by: PTH Jr/TG/BH III

Total Depth Tagged (ft.): **7219.47** EST TD

ChromeCasing

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
1	**41.74**	41.74	7177.73	7219.47	13 Cr 80	47.00	BEAR	
2	**19.58**	61.32	7158.15	7177.73	13 Cr 80	47.00	BEAR	**X**
FC	**2.50**	63.82	7155.65	7158.15	L80	47.00	BEAR	
3	**40.09**	103.91	7115.56	7155.65	13 Cr 80	47.00	BEAR	**X**
4	**40.13**	144.04	7075.43	7115.56	13 Cr 80	47.00	BEAR	**X**
5	**40.05**	184.09	7035.38	7075.43	13 Cr 80	47.00	BEAR	**X**
6	**40.15**	224.24	6995.23	7035.38	13 Cr 80	47.00	BEAR	**X**
7	**40.16**	264.40	6955.07	6995.23	13 Cr 80	47.00	BEAR	**X**
8	**39.55**	303.95	6915.52	6955.07	13 Cr 80	47.00	BEAR	**X**
9	**39.77**	343.72	6875.75	6915.52	13 Cr 80	47.00	BEAR	**X**
10	**19.09**	362.81	6856.66	6875.75	13 Cr 80	47.00	BEAR	**X**
11	**40.18**	402.99	6816.48	6856.66	13 Cr 80	47.00	BEAR	**X**
12	**39.49**	442.48	6776.99	6816.48	13 Cr 80	47.00	BEAR	**X**
13	**40.04**	482.52	6736.95	6776.99	13 Cr 80	47.00	BEAR	**X**
14	**38.91**	521.43	6698.04	6736.95	13 Cr 80	47.00	BEAR	**X**
15	**39.36**	560.79	6658.68	6698.04	13 Cr 80	47.00	BEAR	**X**
16	**38.87**	599.66	6619.81	6658.68	13 Cr 80	47.00	BEAR	**X**
17	**38.52**	638.18	6581.29	6619.81	13 Cr 80	47.00	BEAR	**X**
18	**39.60**	677.78	6541.69	6581.29	13 Cr 80	47.00	BEAR	
19	**39.66**	717.44	6502.03	6541.69	13 Cr 80	47.00	BEAR	**X**
20	**40.12**	757.56	6461.91	6502.03	13 Cr 80	47.00	BEAR	
21	**40.05**	797.61	6421.86	6461.91	13 Cr 80	47.00	BEAR	**X**
22	**39.94**	837.55	6381.92	6421.86	13 Cr 80	47.00	BEAR	
23	**40.03**	877.58	6341.89	6381.92	13 Cr 80	47.00	BEAR	**X**
24	**39.85**	917.43	6302.04	6341.89	13 Cr 80	47.00	BEAR	
25	**40.12**	957.55	6261.92	6302.04	13 Cr 80	47.00	BEAR	**X**
26	**38.76**	996.31	6223.16	6261.92	13 Cr 80	47.00	BEAR	
27	**39.86**	1036.17	6183.30	6223.16	13 Cr 80	47.00	BEAR	**X**
28	**40.04**	1076.21	6143.26	6183.30	13 Cr 80	47.00	BEAR	
29	**40.14**	1116.35	6103.12	6143.26	13 Cr 80	47.00	BEAR	**X**
30	**40.02**	1156.37	6063.10	6103.12	13 Cr 80	47.00	BEAR	
31	**39.63**	1196.00	6023.47	6063.10	13 Cr 80	47.00	BEAR	**X**

ADM CCS WELL #1: Final Casing Tally

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
32	**40.09**	1235.63	5983.84	6023.47	13 Cr 80	47.00	BEAR	
33	**39.90**	1275.53	5943.94	5983.84	13 Cr 80	47.00	BEAR	**X**
34	**39.79**	1315.32	5904.15	5943.94	13 Cr 80	47.00	BEAR	
35	**36.80**	1352.12	5867.35	5904.15	13 Cr 80	47.00	BEAR	**X**
36	**38.86**	1390.98	5828.49	5867.35	13 Cr 80	47.00	BEAR	
37	**40.07**	1431.05	5788.42	5828.49	13 Cr 80	47.00	BEAR	**X**
38	**34.92**	1465.97	5753.50	5788.42	13 Cr 80	47.00	BEAR	
39	**39.95**	1505.92	5713.55	5753.50	13 Cr 80	47.00	BEAR	**X**
40	**40.04**	1545.96	5673.51	5713.55	13 Cr 80	47.00	BEAR	
41	**40.15**	1586.11	5633.36	5673.51	13 Cr 80	47.00	BEAR	**X**
42	**39.62**	1625.73	5593.74	5633.36	13 Cr 80	47.00	BEAR	
43	**39.93**	1665.66	5553.81	5593.74	13 Cr 80	47.00	BEAR	**X**
44	**40.08**	1705.74	5513.73	5553.81	13 Cr 80	47.00	BEAR	
45	**38.45**	1744.19	5475.28	5513.73	13 Cr 80	47.00	BEAR	**X**
46	**39.88**	1784.07	5435.40	5475.28	13 Cr 80	47.00	BEAR	**X**
47	**39.86**	1823.93	5395.54	5435.40	13 Cr 80	47.00	BEAR	**X**
48	**40.05**	1863.98	5355.49	5395.54	13 Cr 80	47.00	BEAR	**X**
49	**40.14**	1904.12	5315.35	5355.49	13 Cr 80	47.00	BEAR	**X**
50	**40.00**	1944.12	5275.35	5315.35	13 Cr 80	47.00	BEAR	
XO	**1.50**	1945.62	5273.85	5275.35	N80	40.00	LTC	**X**
51	**44.26**	1989.88	5229.59	5273.85	N80	40.00	LTC	
52	**47.35**	2037.23	5182.24	5229.59	N80	40.00	LTC	**X**
53	**46.90**	2084.13	5135.34	5182.24	N80	40.00	LTC	
54	**46.95**	2131.08	5088.39	5135.34	N80	40.00	LTC	**X**
55	**47.55**	2178.63	5040.84	5088.39	N80	40.00	LTC	
56	**46.82**	2225.45	4994.02	5040.84	N80	40.00	LTC	**X**
57	**45.12**	2270.57	4948.90	4994.02	N80	40.00	LTC	
58	**43.47**	2314.04	4905.43	4948.90	N80	40.00	LTC	
59	**45.94**	2359.98	4859.49	4905.43	N80	40.00	LTC	**X**
60	**46.56**	2406.54	4812.93	4859.49	N80	40.00	LTC	

ADM CCS WELL #1: Final Casing Tally

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
61	**47.56**	2454.10	4765.37	4812.93	N80	40.00	LTC	
62	**46.29**	2500.39	4719.08	4765.37	N80	40.00	LTC	**X**
63	**46.22**	2546.61	4672.86	4719.08	N80	40.00	LTC	
64	**45.52**	2592.13	4627.34	4672.86	N80	40.00	LTC	
65	**46.50**	2638.63	4580.84	4627.34	N80	40.00	LTC	**X**
66	**47.55**	2686.18	4533.29	4580.84	N80	40.00	LTC	
67	**45.12**	2731.30	4488.17	4533.29	N80	40.00	LTC	
68	**46.01**	2777.31	4442.16	4488.17	N80	40.00	LTC	**X**
69	**46.06**	2823.37	4396.10	4442.16	N80	40.00	LTC	
70	**47.35**	2870.72	4348.75	4396.10	N80	40.00	LTC	
71	**47.36**	2918.08	4301.39	4348.75	N80	40.00	LTC	
72	**46.30**	2964.38	4255.09	4301.39	N80	40.00	LTC	
73	**47.06**	3011.44	4208.03	4255.09	N80	40.00	LTC	
74	**47.10**	3058.54	4160.93	4208.03	N80	40.00	LTC	
75	**46.50**	3105.04	4114.43	4160.93	N80	40.00	LTC	
76	**46.43**	3151.47	4068.00	4114.43	N80	40.00	LTC	**X**
77	**45.77**	3197.24	4022.23	4068.00	N80	40.00	LTC	
78	**47.55**	3244.79	3974.68	4022.23	N80	40.00	LTC	
79	**46.05**	3290.84	3928.63	3974.68	N80	40.00	LTC	
80	**43.08**	3333.92	3885.55	3928.63	N80	40.00	LTC	
81	**46.90**	3380.82	3838.65	3885.55	N80	40.00	LTC	
82	**47.24**	3428.06	3791.41	3838.65	N80	40.00	LTC	
83	**45.10**	3473.16	3746.31	3791.41	N80	40.00	LTC	
84	**47.54**	3520.70	3698.77	3746.31	N80	40.00	LTC	
85	**47.05**	3567.75	3651.72	3698.77	N80	40.00	LTC	
86	**46.93**	3614.68	3604.79	3651.72	N80	40.00	LTC	
87	**47.55**	3662.23	3557.24	3604.79	N80	40.00	LTC	**X**
88	**46.65**	3708.88	3510.59	3557.24	N80	40.00	LTC	
89	**47.34**	3756.22	3463.25	3510.59	N80	40.00	LTC	
90	**47.43**	3803.65	3415.82	3463.25	N80	40.00	LTC	

ADM CCS WELL #1: Final Casing Tally

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
91	**47.46**	3851.11	3368.36	3415.82	N80	40.00	LTC	
92	**46.55**	3897.66	3321.81	3368.36	N80	40.00	LTC	
93	**47.26**	3944.92	3274.55	3321.81	N80	40.00	LTC	
94	**47.45**	3992.37	3227.10	3274.55	N80	40.00	LTC	
95	**47.24**	4039.61	3179.86	3227.10	N80	40.00	LTC	
96	**46.35**	4085.96	3133.51	3179.86	N80	40.00	LTC	
97	**47.55**	4133.51	3085.96	3133.51	N80	40.00	LTC	**X**
98	**47.33**	4180.84	3038.63	3085.96	N80	40.00	LTC	
99	**47.36**	4228.20	2991.27	3038.63	N80	40.00	LTC	
100	**46.29**	4274.49	2944.98	2991.27	N80	40.00	LTC	
101	**47.24**	4321.73	2897.74	2944.98	N80	40.00	LTC	
102	**47.38**	4369.11	2850.36	2897.74	N80	40.00	LTC	
103	**45.35**	4414.46	2805.01	2850.36	N80	40.00	LTC	
104	**47.35**	4461.81	2757.66	2805.01	N80	40.00	LTC	
105	**46.63**	4508.44	2711.03	2757.66	N80	40.00	LTC	
106	**47.53**	4555.97	2663.50	2711.03	N80	40.00	LTC	
107	**46.70**	4602.67	2616.80	2663.50	N80	40.00	LTC	
108	**47.25**	4649.92	2569.55	2616.80	N80	40.00	LTC	**X**
109	**47.53**	4697.45	2522.02	2569.55	N80	40.00	LTC	
110	**47.25**	4744.70	2474.77	2522.02	N80	40.00	LTC	
111	**46.13**	4790.83	2428.64	2474.77	N80	40.00	LTC	
112	**45.49**	4836.32	2383.15	2428.64	N80	40.00	LTC	
113	**47.26**	4883.58	2335.89	2383.15	N80	40.00	LTC	
114	**46.63**	4930.21	2289.26	2335.89	N80	40.00	LTC	
115	**45.76**	4975.97	2243.50	2289.26	N80	40.00	LTC	
116	**47.54**	5023.51	2195.96	2243.50	N80	40.00	LTC	
117	**47.32**	5070.83	2148.64	2195.96	N80	40.00	LTC	
118	**45.78**	5116.61	2102.86	2148.64	N80	40.00	LTC	
119	**47.34**	5163.95	2055.52	2102.86	N80	40.00	LTC	**X**
120	**45.89**	5209.84	2009.63	2055.52	N80	40.00	LTC	

ADM CCS WELL #1: Final Casing Tally

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
121	**45.72**	5255.56	1963.91	2009.63	N80	40.00	LTC	
122	**46.23**	5301.79	1917.68	1963.91	N80	40.00	LTC	
123	**46.55**	5348.34	1871.13	1917.68	N80	40.00	LTC	
124	**47.04**	5395.38	1824.09	1871.13	N80	40.00	LTC	
125	**46.95**	5442.33	1777.14	1824.09	N80	40.00	LTC	
126	**46.22**	5488.55	1730.92	1777.14	N80	40.00	LTC	
127	**45.86**	5534.41	1685.06	1730.92	N80	40.00	LTC	
128	**46.96**	5581.37	1638.10	1685.06	N80	40.00	LTC	
129	**46.58**	5627.95	1591.52	1638.10	N80	40.00	LTC	**X**
130	**47.54**	5675.49	1543.98	1591.52	N80	40.00	LTC	
131	**47.34**	5722.83	1496.64	1543.98	N80	40.00	LTC	
132	**46.12**	5768.95	1450.52	1496.64	N80	40.00	LTC	
133	**47.35**	5816.30	1403.17	1450.52	N80	40.00	LTC	
134	**46.37**	5862.67	1356.80	1403.17	N80	40.00	LTC	
135	**45.06**	5907.73	1311.74	1356.80	N80	40.00	LTC	
136	**47.26**	5954.99	1264.48	1311.74	N80	40.00	LTC	
137	**47.28**	6002.27	1217.20	1264.48	N80	40.00	LTC	
138	**47.55**	6049.82	1169.65	1217.20	N80	40.00	LTC	
139	**46.65**	6096.47	1123.00	1169.65	N80	40.00	LTC	
140	**45.34**	6141.81	1077.66	1123.00	N80	40.00	LTC	
141	**47.34**	6189.15	1030.32	1077.66	N80	40.00	LTC	**X**
142	**45.84**	6234.99	984.48	1030.32	N80	40.00	LTC	
143	**47.54**	6282.53	936.94	984.48	N80	40.00	LTC	
144	**46.86**	6329.39	890.08	936.94	N80	40.00	LTC	
145	**46.50**	6375.89	843.58	890.08	N80	40.00	LTC	
146	**44.99**	6420.88	798.59	843.58	N80	40.00	LTC	
147	**45.95**	6466.83	752.64	798.59	N80	40.00	LTC	
148	**47.55**	6514.38	705.09	752.64	N80	40.00	LTC	
149	**47.47**	6561.85	657.62	705.09	N80	40.00	LTC	
150	**47.03**	6608.88	610.59	657.62	N80	40.00	LTC	

ADM CCS WELL #1: Final Casing Tally

X = BOW SPRING CENTRALIZER @ CASING COUPLINGS

Jt #	Length	Total	Top	Bottom	Grade	Wt	Thread	Cent.
151	**47.25**	6656.13	563.34	610.59	N80	40.00	LTC	**X**
152	**47.37**	6703.50	515.97	563.34	N80	40.00	LTC	
153	**46.62**	6750.12	469.35	515.97	N80	40.00	LTC	
154	**47.54**	6797.66	421.81	469.35	N80	40.00	LTC	
155	**47.32**	6844.98	374.49	421.81	N80	40.00	LTC	
156	**47.33**	6892.31	327.16	374.49	N80	40.00	LTC	
157	**46.53**	6938.84	280.63	327.16	N80	40.00	LTC	
158	**43.42**	6982.26	237.21	280.63	N80	40.00	LTC	**X**
159	**47.54**	7029.80	189.67	237.21	N80	40.00	LTC	
160	**47.54**	7077.34	142.13	189.67	N80	40.00	LTC	
161	**47.53**	7124.87	94.60	142.13	N80	40.00	LTC	
162	**47.35**	7172.22	47.25	94.60	N80	40.00	LTC	
163	**47.25**	7219.47	0.00	47.25	N80	40.00	LTC	
~~164~~	~~47.12~~	~~7266.59~~	~~-47.12~~	~~0.00~~	~~N80~~	~~40.00~~	~~LTC~~	
~~165~~	~~47.55~~	~~7314.14~~	~~-94.67~~	~~-47.12~~	~~N80~~	~~40.00~~	~~LTC~~	
~~166~~	~~46.33~~	~~7360.47~~	~~-141.00~~	~~-94.67~~	~~N80~~	~~40.00~~	~~LTC~~	
~~167~~	~~45.47~~	~~7405.94~~	~~-186.47~~	~~-141.00~~	~~N80~~	~~40.00~~	~~LTC~~	
~~168~~	~~46.93~~	~~7452.87~~	~~-233.40~~	~~-186.47~~	~~N80~~	~~40.00~~	~~LTC~~	
~~169~~	~~47.38~~	~~7500.25~~	~~-280.78~~	~~-233.40~~	~~N80~~	~~40.00~~	~~LTC~~	
~~170~~	~~47.53~~	~~7547.78~~	~~-328.31~~	~~-280.78~~	~~N80~~	~~40.00~~	~~LTC~~	
~~171~~	~~47.34~~	~~7595.12~~	~~-375.65~~	~~-328.31~~	~~N80~~	~~40.00~~	~~LTC~~	
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Appendix XIII.A – Revised Form 4a

4 UIC Form 4a, Hydrogeologic Information

Last revised: 4/29/2010 (note: EM added page numbers to this section).

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
UNDERGROUND INJECTION CONTROL PERMIT APPLICATION

FORM 4a - HYDROGEOLOGIC INFORMATION

USEPA I.D. NUMBER ILD984791459
IEPA I.D. NUMBER 1150155136
UIC Well Number CCS #1

I Elevation of Land Surface at Well Location

The surface elevation at the CCS#1 well is 674.22 feet above mean seal level (MSL). During well drilling, the reference elevation was the rig's kelly bushing, which had an elevation of 689.85 feet above MSL.

II Faults, known or suspected within the area of review

No regional faults that are known to cross the area of review. Analysis of the current seismic reflection data showed no observable faults. The CCS#1 did not penetrate any known faults. As discussed in the Feasibility Report, the original 2D seismic reflection data acquired before the well was drilled suggested that possible fractured intervals may be found in the Mt. Simon. A review of the original seismic reflection data suggests that these fractured zones may be artifacts of poor quality data. Noise from the nearby ADM industrial plant and the Caterpillar plant on the west side of the study area reduces the quality of the seismic data and limits our ability to draw firm conclusions from the seismic data

III Maps and cross sections as required by Section 730.114(a) or 730.134(a)

Maps and cross-sections perpendicular to each other at the ADM injection site were shown in Figures 20-22 of the Feasibility Report. The cross-sections included available log control, geologic units, and lithology from the surface to the lower confining bed below the injection zone. The closest Mt. Simon well to the Decatur area (17 miles southeast of CCS#1) is the Sanders #7. The Sanders #7 only drilled the uppermost 200 feet of the Mt. Simon and did not penetrate the deeper reservoir zone. Unfortunately, there were no deep wells that penetrated the Knox, Ironton-Galesville, Eau Clare (the primary seal), or Mt. Simon Sandstone within a 17 mile radius of the proposed injection site. All of the deeper horizons are projected from regional mapping.

The closest wells that penetrate the injection horizon are 51 miles (Weaber-Horn #1) and 37 miles (Hinton#7) from the CCS#1 well. The Weaber-Horn #1 well had an average Mt. Simon reservoir porosity of about 12 percent, as calculated from wireline logs. The Weaber-Horn #1 well porosity data are similar to those found in the Hinton #7 at the Manlove Gas Storage Field in Champaign County. The Manlove Field is the deepest Mt. Simon gas storage field in the Illinois Basin and provides one of the best sets of reservoir data for characterization of the deep Mt. Simon. As expected the porosity values at the CCS#1 well are similar to those found at the Weaber-Horn #1 well and the Manlove Gas Storage Field. A north-south trending cross section (see A-A' in Figure CCS1_hinton_xsd_Mehnert.pdf, Figure 4a1) across the Hinton #7, CCS#1, Harrison #1, and Weaber-Horn #1 wells shows that the Mt. Simon at the CCS#1 well has the same lower porous and permeable interval.

IV Injection Zone

Regional

The thickest and most widespread saline water bearing reservoir (saline reservoir) in the Illinois Basin is the Cambrian-age Mt. Simon Sandstone (Figure 4a2). CO_2 injected through CCS#1 will be contained in the injection zone. The initial injection interval is a portion of the Mt. Simon where the injection well is perforated, between depths of 6,982 to 7,050 feet.

It is overlain by the Cambrian Eau Claire Formation, a regionally extensive very low-permeability shale, and underlain by the Precambrian granitic basement.

The regional properties and thickness of the Mt. Simon were discussed in the Feasibility Report.

A. Geologic name(s) of injection zone.

The injection zone is the Cambrian-age Mt. Simon Sandstone (Figure 4a2). CO_2 injected through CCS#1 will be contained in the injection zone and will flow into the Mt. Simon at the injection interval. The injection interval is a portion of the Mt. Simon where the injection well is perforated.

B. Depth interval of injection zone beneath land surface

At the ADM site, the Mt. Simon was found at a depth of 5,545 feet to 7,051 feet based on borehole logging data. An interval of high porosity and permeability was identified at the base of the Mt. Simon. This interval was selected as the initial injection interval and was perforated from 6,982 to 7,050 ft.

C. Characteristics of injection zone.

The injection zone is a porous and permeable sandstone that, in some intervals, is an arkose. Grain size varies from very-fine grained to coarse grained. The sandstones are primarily composed of quartz, but some sandstone intervals can contain more than 15 percent feldspar. Diagenetic clay minerals are not common.

2. Injection zone thickness available to accept waste.

While CO_2 may be stored in the entire thickness of the Mt. Simon, CO_2 will be initially injected at the perforated or injection interval at the base of the Mt. Simon. CCS#1 is perforated at a depth of 6,982 to 7,050 feet.

3. Fracture pressure at top of injection interval

A step-rate test was conducted on September 26, 2009 into the initial 25 foot perforated interval from 7,025 to 7,050 feet at the base of the Mt. Simon (Earlougher, 1977). The primary purpose of the test was to estimate the fracture pressure of the injection interval. A bottom-hole pressure gauge with surface readout was used. The pressure gauge was located at 6,891 feet inside the tubing, 134 feet above the upper-most perforation.

Water with clay stabilizing potassium chloride was injected in 2.0 barrel per minute (bpm) increments starting at 2.0 bpm (84 gallons per min, gpm) to 8.0 bpm (336 gpm). Each rate was maintained for approximately 45 minutes. The pressure near the end of each injection period was plotted against the injection rate in Figure 4a3 to determine the fracture pressure.

The first line with the greater slope at lower rates and pressure is the perforated interval's response to water injection prior to fracturing. The second line with the lower slope at higher rates and pressures is after the fracture developed. The intersection of the two straight lines is 4,966 psig. To find the fracture pressure at the top of the perforations, the hydrostatic pressure of the water in the wellbore between 6,891 (location of pressure gauge) and 7,025 feet was added to the 4,966 psig. The fracture pressure at 7,025 feet is 5,024 psig.

Source:
Earlougher, Jr., R.C., 1977. *Advances in Well Test Analysis*, Monograph Series, Society of Petroleum Engineers of AIME, Dallas, **5**.

4. Effective porosity, include source

The compensated neutron and litho-density open-hole, porosity logs run were run in CCS#1. The neutron and density logs provide total porosity data. Effective porosity was determined by lab testing using the helium porosimeter method on a limited number of core plug samples. See Section X for additional discussion about the helium porosimeter method.

A comparison was made between the neutron-density crossplot porosity (average neutron and density porosity) and core porosity (Figure 4a4). These porosity sources compared well. Consequently, the neutron-density crossplot porosity was used to estimate effective porosity.

Based on porosity trends, there are 7 major sub-intervals present in the Mt. Simon. Table 4a1 lists the intervals identified and the average effective porosity of each. Based on the neutron-density crossplot porosity, the 68-foot, injection interval (6,982-7,050 feet) has an average effective porosity of 21.0%.

Table 4a1: Average effective porosity based on the neutron-density crossplot porosity. The seven sub-intervals were selected based on major changes in the trend of porosity from the neutron-density logs.

Sub-Interval (feet)	Effective Porosity (%)
5,545-5,900	10.8
5,900-6,150	8.72
6,150-6,430	10.1
6,430-6,650	15.2
6,650-6,820	21.8
6,820-7,050	18.7
7,050-7,165	9.84

5. Intrinsic permeability, include source

Intrinsic permeability was directly available from core analyses and well testing. However, to estimate permeability over a larger interval where core is not available, a relationship between core permeability and log porosity is required.

Core Analysis

A core porosity-permeability transform was developed (Figure 4a5) based on grain size. A neutron-density crossplot porosity was used with this transform to estimate permeability with depth. Average permeability for sub-intervals of the Mt. Simon for CCS#1 is in Table 4a2. Based on the neutron-density crossplot porosity and the core porosity-permeability transform, the 68-foot, injection (perforated) interval (6,982-7,050 feet) has an average intrinsic permeability of 194 md.

Well Testing

Three pressure falloff (PFO) tests of varying duration were conducted in September and October 2009 as part of the initial completion of CCS#1. A pressure falloff test involves two segments. During the first test segment, the reservoir is stressed by injecting fluid, which changes the reservoir pressure. During the second test segment, the reservoir pressure is monitored as it returns to its pre-test pressure. An analogous test in the groundwater industry is a recovery test where water is pumped instead of injected during the first test segment.

The initial perforations in the injection interval were 7,025 to 7,050 feet. Water treated with a clay-stabilizing potassium chloride substitute was injected at 1.5 to 2.0 barrels per minute (bpm) (63 to 84 gallons per minute) for nearly two hours. A 19.5 hour PFO followed this injection period.

After this test, these perforations were acidized and a step-rate test was conducted. For the second step-rate test, treated water was injected at 3.1 bpm (130 gpm) for five hours, while pressure was monitored for approximately 45 hours.

The third PFO test was conducted after the well was perforated and stimulated. An additional 30 feet of perforations were added at 6,982 to 7,012 feet. The perforated zone received a second acid treatment. Additional information regarding perforations and acid treatment are described in Completion Report Form 4h, Section X.E. For the third PFO test, the treated water was injected at an increasing rate of 3.1 to 4.2 bpm (130 to 176 gpm) over 6.5 hours and then at 4.2 bpm (176 gpm) for an additional 6.5 hours. During this third PFO test, pressure was monitored for 105 hours.

Pressure Transient Analyses

PIE pressure transient software (Well-Test Solutions, Ltd., http://welltestsolutions.com/index.html) was used to analyze the pressure data for reservoir flow properties. Conventional semilog, log-log and nonlinear regression analyses were used to analyze the data.

During the first PFO, because only 25 feet of perforations were open in a very large vertical formation (gross thickness 1,506 feet), a partial penetration or partial completion effect was expected. The derivative (log-log plot) of the falloff test is used to qualitatively identify reservoir features including the partial penetration effect (Figure 4a6) and to determine permeability. Two radial, 2-dimensional responses (horizontal derivative) were measured during this test between 0.1 and 1 hrs (PPNSTB) and 20 to 100 hrs (STABIL). The first period corresponds to radial flow across the 25 ft perforated interval; the second period corresponds to the pressure response across a larger thickness that would be between two much lower permeability sub-units. The transition between the two radial responses (SPHERE) is a spherical flow (3-dimensional flow) period that is influenced by vertical permeability (or kv/kh, the ratio of vertical to horizontal permeability).

To observe the effect of the acid treatment and the second set of perforations to the overall injection interval, the derivatives of the three pressure falloff tests were overlain (Figure 4a7). The data between 0.1 and 1.0 hrs match relatively well and the data between 1.0 and 100 hrs match very well. Similar trends of the first radial period, transition and final radial period indicates that the second set of perforations did not change the permeability estimated from the pressure transient tests or contribute to the perforated interval. As such the subsequent pressure transient analyses used a single layer, partial penetration model with 25 ft of perforations open at the base of the layer.

Simulation of the pressure transient data using analytical solutions (Figure 4a8), gave a permeability of 185 md over 75 ft of vertical thickness. The transition period gave a vertical permeability over the 75 ft as 2.45 md (kv/kh = 0.01326).

The Mt. Simon initial pressure at CCS#1 at 7,025 ft is about 3,200 psig.

The average Mt. Simon permeability for all of the cored Mt. Simon Sandstone was 29.7 md for the Manlove Field. These permeability values includes both reservoir and non-reservoir facies. The average permeability of the porous and permeable intervals of the Manlove Field is expected to be several hundred millidarcy. The permeability in the lower interval (injection interval of interest) had a sidewall core plug in the Hinton #7 well with permeability in excess of 1,000 md. Thus, the estimated mean permeability for CCS #1 is similar to other estimates of Mt. Simon in the Illinois Basin.

For the injection interval, the permeability estimates from three methods are very close. Based on the neutron-density crossplot porosity and the core porosity-permeability transform, the 68-foot, injection (perforated) interval (6,982 to 7,050 feet) has an average intrinsic permeability of 194 md Using the PIE pressure transient software for the third PFO, permeability was estimated to be 185 md over 75 ft of vertical thickness. Permeability for this same 75 feet of rock was calculated using core and well log analyses. The permeability from this analysis was estimated to be 182 md.

Table 4a2: Average intrinsic permeability based on a transform of core permeability and core porosity related to the neutron-density crossplot porosity for the sub-intervals shown. The seven sub-intervals were selected based on major changes in the trend of porosity from the neutron-density logs.

Sub-Interval (feet)	Intrinsic Permeability (md)
5,545-5,900	19.4
5,900-6,150	10.2
6,150-6,430	8.44
6,430-6,650	8.21
6,650-6,820	8.64
6,820-7,050	107
7,050-7,165	4.37

6. Hydraulic conductivity or permeability, include source

Intrinsic permeability (k) and hydraulic conductivity (K) are related according to the following equation (Freeze and Cherry, 1979):

$$K = k \rho g / \mu$$

where ρ= fluid density

g= gravitational acceleration

μ= dynamic viscosity

Intrinsic permeability (k) is a property of the rock, while hydraulic conductivity (K) includes properties of the rock and fluid. Intrinsic permeability is also known as permeability and is discussed in Section IV.C.5. Formation water density and dynamic viscosity are discussed in Sections IV.D.3 and IV.D.4, respectively. For the range of viscosity and density discussed, the hydraulic conductivity will vary.

The injection interval (6,982 to 7,050 feet) had an average intrinsic permeability of 194 md, this converts to a hydraulic conductivity of 3.9×10^{-6} m/sec, using the fluid properties at this depth.

Source:

Freeze, R. A. and J. A. Cherry, 1979. *Groundwater*. Englewood Cliffs, N.J., Prentice-Hall, Inc.

7. Storage coefficient, include source

The storage coefficient or storativity, S, ranges from 5×10^{-5} to 5×10^{-3} for confined aquifers (Freeze and Cherry, 1979). S is commonly determined by well testing; however, S is a function of fluid compressibility (c_f) and rock compressibility (c_r) and can be estimated from the following equation:

$$S = \rho g h (c_r + \phi c_f)$$

where ϕ= porosity

h= formation thickness

ρ= fluid density

g= gravitational acceleration

Rock compressibility can be expressed as the inverse of the bulk modulus (K_b) and in terms of the Young's modulus (E) and Poisson's ratio (ν) (Huang and Rudnicki, 2006):

$$c_r = 1/K_b = 3(1 - 2\nu)/E$$

Fluid density is discussed in Section IV.D.3. Gravitational acceleration equals 9.81 m/sec^2. For this calculation, the Mt. Simon is assumed to be 1,506 feet thick and have 10% porosity (Φ). Young's modulus (E) and Poisson's ratio (ν) were determined by Weatherford Laboratory (see Section X for more details) for Mt. Simon samples collected at depths of 6,761 and 6,770 feet. These values were used to compute c_r using the equation shown above. These compressibility values are consistent with bulk compressibility values for sandstone reservoirs, which ranged from 6.5x10^{-5} to 2.7x10^{-4} MPa^{-1} at 7,000 psi (48.3 MPa) confining pressure (Zimmerman, 1991). Fluid compressibility (c_f) are known to vary with pressure and temperature changes (Huang and Rudnicki, 2006). Using two samples collected from CCS#1 (MDT-1 & MDT-4), fluid compressibility and storativity values were estimated (Table 4a4).

Based on the range of values described here, storativity was estimated to range from 8.1x10^{-5} to 9.3x10^{-4} (Table 4a3). These values area consistent with values published by Freeze and Cherry (1979).

Table 4a3. Estimates of rock (c_r) and fluid (c_f) compressibility and storativity (S)

depth (ft)	pressure (psi)	pressure (MPa)	T (°C)	ρ (g/L)	c_r (1/Mpa)	c_f (1/Mpa)	Φ (-)	h (m)	S (-)
5772	2582.9	1.78E+01	48.8	1089.7	2.02E-04	2.04E-04	0.10	459.0	8.91E-04
7045	3206.1	2.21E+01	52.1	1123.5	2.02E-04	1.83E-04	0.10	459.0	9.29E-04
5772	2582.9	1.78E+01	48.8	1089.7	3.68E-05	2.04E-04	0.10	459.0	8.07E-05
7045	3206.1	2.21E+01	52.1	1123.5	3.68E-05	1.83E-04	0.10	459.0	9.35E-05

Source:

Huang, T. and J.W. Rudnicki, 2006. A mathematical model for seepage of deeply buried groundwater under higher pressure and temperature. *Journal of Hydrology* 327(1-2): 42-54.

Freeze, R.A. and J.A. Cherry, 1979. *Groundwater*. Englewood Cliffs, N.J., Prentice-Hall, Inc.

Zimmerman, R.W., 1991. Compressibility of Sandstones. Amsterdam, Elsevier.

8. Seepage velocity (ft/yr) and flow direction of formation water, include source.

Groundwater flow in the deeper part of the Illinois Basin was discussed in the Feasibility Report and included model projections of groundwater flow in the Mt. Simon by Gupta and Bair (1997). The location of the CCS#1 was plotted on the potentiometric surface map developed by Gupta and Bair (1997). The potentiometric surface was estimated to be 76 m (250 ft) in Section IV.D.6, which is slightly higher than the projected estimate of 25 to 50 m from Figure 4a9 (gupta&bair_1997_revisedkorose.jpg).

References

Gupta, N., and E.S. Bair, 1997. Variable-density flow in the midcontinent basins and arches region of the United States. Water Resources Research, 33(8): 1785-1802.

D. Characteristics of injection zone formation water

Fluid samples were collected from the CCS#1 open borehole, after drilling and wireline geophysical testing were completed. Schlumberger's Modular Formation Dynamics Tester (MDT) and

Quiksilver wireline equipment were run on April 28 and 29, 2009. The tool was used to collect formation pressure, formation temperature, and high-quality reservoir fluid samples at five depths (Table 4a4). Prior to collecting a reservoir sample, the MDT measures the fluid resistivity to help discriminate between formation fluids and drilling mud filtrate. Fluid sample volume varied from 450 mL to 900 mL. These samples were analyzed by the Illinois State Water Survey.

Table 4a4. Data for fluid samples collected from the Mt. Simon sandstone using the MDT sampler in April 2009

Sample ID	Sample Depth (feet)	Formation Pressure (psi)	Formation Temperature (°F)	TDS (mg/L)	Density (g/L)
MDT-4	5,772	2,582.9	119.8	164,500	1,089.7
MDT-3	6,764	3,077.5	125.1	185,600	1,120.7
MDT-14	6,764	3,077.5	125.1	179,800	NA
MDT-5	6,840	3,105.9	125.0	182,300	1,124.1
MDT-2	6,912	3,141.8	125.8	211,700	1,136.5
MDT-9	6,840	3,105.9	125.0	219,800	NA
MDT-1	7,045	3,206.1	125.7	228,100	1,123.5
MDT-8	7,045	3,206.1	125.7	201,500	NA

NA= not analyzed

1. Temperature, include source

Based on the MDT sampler (Table 4a4), formation temperatures ranged from 119.8°F (48.8 °C) at a depth of 5,772 feet to 125.8°F (52.1°C) at depth of 6,912 feet.

2. Pressure, include source

Assuming a pressure gradient of 0.433 psi/feet, the pressure at the top of the Mt. Simon was estimated to be between 2,165 to 2,598 psi for estimated depths of 5,000 to 6,000 feet. The formation pressure measured with the MDT tool also varied with depth and had a minimum pressure of 2,583 psi recorded at 5,772 feet and a maximum pressure of 3,206 psi recorded at 7,045 feet.

3. Density, include source

Based on five samples collected with the MDT sampler, the fluid density ranged from 1,090 to 1,137 g/L, with an average of 1,119 g/L.

4. Viscosity, include source

Dynamic viscosity is a function of brine temperature, salinity, and formation pressure. Viscosity increases with higher salinity and with lower temperatures. Viscosity slightly increases with higher formation pressure (Kestin et al., 1981). Kestin et al. (1981) studied the viscosity of NaCl brines. Because the Mt. Simon brine is predominantly an NaCl brine, using the method of Kestin et al. (1981) is appropriate.

Using the data in Table 4a4, the brine viscosity for the Mt. Simon brine is estimated to range from 5.4×10^{-4} to 5.7×10^{-4} Pa sec with an average of 5.5×10^{-4} Pa sec.

Source:

Kestin, J., E. Khalifa and R.J. Correia, 1981. Tables of dynamic and kinematic viscosity of aqueous NaCl solutions in the temperature range 20-150°C and the pressure range 0.1-35MPa., *Journal of Physical and Chemical Reference Data,* 10(1): 71-87.

5. Total Dissolved Solids, include source

Salinity, expressed as TDS, also affects the injection capacity because it reduces the CO_2 solubility in water. Figure 17 in the Feasibility report showed the broad distribution of TDS in the Mt. Simon which should exceed 60,000 mg/L over much of the Illinois Basin and 180,000 mg/L in the deeper portions of the basin (Leetaru et al., 2005).

At the ADM site, the Mt. Simon brine was expected to be 100,000 to 140,000 mg/L TDS. Samples collected from the injection well varied with depth (Table 4a4), with TDS of 164,500 mg/L TDS at 5,772 feet and 228,100 mg/L TDS at 7,045 feet. The average TDS for the eight samples is 196,700 mg/L.

Source:

Leetaru, H., E. Mehnert, S. Rittenhouse, J. Drahovzal, S. Fisher, and J. McBride, 2005. Saline reservoirs as a sequestration target, in An Assessment of Geological Carbon Sequestration Options in the Illinois Basin, Final Report for U.S. DOE Contract: DE-FC26-03NT41994, Principal Investigator: Robert Finley, p 253-324.

6. Potentiometric surface, include source

Little information is available about the potentiometric surface in the Mt. Simon sandstone in Macon County because very few wells penetrate the Mt. Simon in central Illinois. The best available information regarding the potentiometric surface is discussed in Section IV.C.8 of this form.

Using the formation pressure (p) and fluid density (ϱ) data in Table 4a4, the potentiometric head (h) was calculated using the relationship—$p= \varrho gh$, where g is the gravitational constant. The mean potentiometric head in the Mt. Simon has an elevation 249.5 feet above mean sea level. If the well were filled with freshwater (ϱ= 1,000 g/L), the potentiometric head would have an elevation of 996.1 feet.

E. Additional or alternative zones considered for injection

No other geologic zones are being considered for injection at the ADM site.

V. Upper Confining Zone

A. Geologic name(s) of confining zone

The primary confining zone (seal) is the Cambrian-age Eau Claire Formation (Figure 4a2). An isopach map based on regional well control suggests that the Eau Claire should be 300 to 500 feet thick at the

ADM site. Based on the data from CCS#1, the Eau Claire has a total thickness of 497.5 feet. The shale section of the Eau Claire has a thickness of 198.1 feet and is the lowermost section within the Eau Claire.

B. Depth interval of upper confining zone beneath land surface.

The Eau Claire Formation occurs at a depth of 5,047 feet to 5,545 feet below ground surface. The shale section of the Eau Claire occurs at a depth of 5,347 to 5,545 feet.

C. Characteristics of confining zone

<u>1. Lithologic description</u>

In the central part of the Illinois Basin, the Cambrian age Eau Claire Formation is a mixture of carbonates and fine-grained siliciclastics. At CCS#1, the upper section of the Eau Claire (5,047 to 5,347 feet) was dense limestone with thin stringers of siltstone. The lower section of the Eau Claire (5,347 to 5,545 feet) was a shale. As discussed in the Feasibility Report, the Eau Claire shale interval above the Mt. Simon is persistent in the Illinois Basin and is expected to provide a good seal for the injection zone.

From limited x-ray diffraction data, the mineraology of the shale is 60 percent clay minerals and 37 percent quartz and potassium feldspar. The shale is thinly laminated and dark gray to black in color.

<u>2. Fracture pressure at depth, include source</u>

A mini-frac test using Schlumberger's Modular Dynamics Testing tool was conducted across a 2.8-foot interval centered at a depth of 5,435 feet. Thus, this mini-frac test was conducted on the shale section of the Eau Claire formation. The test was designed for four, short-term injection/falloff test periods (15 to 60 minutes in duration). The fracture pressure from these four tests ranged from 5,078 to 5,324 psig, corresponding to a fracture gradient ranging from 0.93 to 0.98 psi/ft in the Eau Claire Shale.

<u>3. Intrinsic permeability, include source</u>

None of the sidewall rotary core plugs are described as shale. From the whole core, taken within the Eau Claire, no part of the shale was large enough for drilling a core plug and subsequent analyses. The sidewall rotary core plugs are taken horizontally, so permeability from these plugs is horizontal (not vertical) permeability which is less relevant for a confining layer.

The plugs are described as very fine grained sandstones, microcrystalline limestone and siltstone. Within the upper confining interval of 5,047 to 5,545 feet, 12 plugs were available for porosity and permeability testing. Because vertical flow is of most interest for the upper confining layer, the average vertical permeability over the confining layer was estimated. The average vertical permeability using the horizontal permeability from the 12 sidewall rotary core plugs is 0.000344 md.

The average vertical permeability over the upper confining layer is expected to be much lower than 0.000344 md because this average is based on horizontal permeability values and no shale permeability was included. Vertical permeability on plugs is generally lower than horizontal permeability and shale permeability is generally much lower than sandstone, limestone, and siltstone.

4. Hydraulic conductivity, include source

Intrinsic permeability (k) and hydraulic conductivity (K) are related according to the following equation (Freeze and Cherry, 1979):

$$K= k \rho g/\mu$$

where ρ = fluid density

g= gravitational acceleration

μ= dynamic viscosity

Intrinsic permeability (k) is a property of the rock, while hydraulic conductivity (K) includes properties of the rock and fluid. Intrinsic permeability is also known as permeability and is discussed in Section IV.C.5. Fluid density is discussed in Section IV.D.3, while dynamic viscosity is discussed in Section IV.D.4. No fluid samples were collected from the Eau Claire. For these calculations, the fluid properties of sample MDT-4 (Table 4a4) were used. This Mt. Simon brine sample was collected closest to the Eau Claire. Its measured properties include temperature of 119.8°F and density of 1,089.7 g/L. Its dynamic viscosity was estimated to be 758.0 microPa sec. For an intrinsic permeability values of 0.000344 md, the hydraulic conductivity equals 4.8×10^{-12}m/sec.

Sources:

Freeze, R. A. and J. A. Cherry, 1979. *Groundwater*. Englewood Cliffs, N.J., Prentice-Hall, Inc.

5. Alternative confining zones proposed, include explanation and depth interval(s)

Secondary seals provide additional backup containment of the CO_2 should an unlikely failure of the primary seal occur. Secondary seals listed here are units with low permeability that are regionally present and serve as cap rocks for oil, gas and gas storage fields throughout Illinois where they are present.

Two secondary seals were found at the ADM site. The Ordovician-age Maquoketa Shale (Figure 4a2) is laterally continuous across the ADM site and is 206 feet thick at the ADM site at a depth of 2,611 feet below ground. This shale is a regional seal for production from the Ordovician Galena (Trenton) Limestone. The Devonian-Mississippian-age New Albany Shale at a depth of 2,088 feet is about 126 feet thick at the ADM study area. Extensive well control from oil fields shows that this shale is a good seal for hydrocarbons; hence, it should also be a good secondary seal against the vertical migration of CO_2.

VI. Lower Confining Zone

Because the lower confining zone is the basement granite and no other sedimentary rocks are below the granite, no data were collected on the granite. The fracture pressure, porosity and permeability of the granite will not impact injection or fluid migration as the CO_2 injection interval will be above this confining zone and the CO_2 is expected to move upward away from the granite.

A. Geologic name(s) of confining zone

The lower confining zone is the Precambrian granite basement.

B. Depth interval of lower confining zone beneath land surface

The top of the Precambrian basement rock was found at a depth of 7,165 feet below ground surface.

C. Characteristics of confining zone

<u>1. Lithologic description</u>

The Precambrian-age rock in the Illinois Basin is composed of a medium- to coarse-grained granite or rhyolite and is between 1.1 to 1.4 billion years old (Bickford et al., 1986). At the CCS#1 well, we encountered the Precambrian granite/rhyolite at a measured depth of 7,165 feet.

Source:

Bickford, M.E., W.R. Van Schmus, and I. Zietz, 1986. Proterozoic history of the midcontinent region of North America: Geology, (14) 6, 492–496.

<u>2. Fracture pressure at depth, include source</u>

The Illinois State Geological Survey could not find any data on fracture pressure of granites in Illinois nor did we conduct any tests to determine the fracture pressure of the lower confining zone. The fracture pressure of the granite is not anticipated to have any effect on the injection or storage of CO_2 in the Mt. Simon.

<u>3. Intrinsic permeability, include source</u>

The top of the granite occurs at depth of 7,165 feet. A total of 65 feet of granite was drilled. At 7,200 feet, one core plug was collected; the permeability was 0.0091 mD.

<u>4. Hydraulic conductivity, include source</u>

Using the pressure and fluid properties obtained for MDT-1 (Table 4a4), hydraulic conductivity for the granite is estimated to be 1.8×10^{-10} m/sec.

<u>5. Alternative confining zones proposed, include explanation and depth interval(s)</u>

There are no alternative lower confining zones since no wells in Illinois have found anything else but the Precambrian granite basement below the Mt. Simon Sandstone.

VII. Overlying Sources of Groundwater at the Site

Overlying sources of groundwater which meet the definition of underground sources of drinking water (USDW) include three units from shallowest to deepest—Quaternary sand and gravel, Pennsylvanian bedrock, and the St. Peter Sandstone. Field investigations to determine the lowermost USDW at this site were discussed in a letter from Dean Frommelt of ADM to Illinois EPA, dated September 29, 2009.

Summarizing the information in this letter, water sampling showed that the water in the St. Peter Sandstone had a total dissolved solids (TDS) concentration of 4,540 mg/L, which is below the USDW limit of 10,000 mg/L TDS. In addition, the water quality in the Pennsylvanian bedrock transitions from fresh water (TDS < 10,000 mg/L) to brine (TDS > 10,000 mg/L) with depth. Currently, groundwater in the Pennsylvanian bedrock below 275 feet is considered brine. Additional monitoring wells will be installed in 2010 to help establish the boundary between the fresh water and brine in the Pennsylvanian bedrock.

Source:

Frommelt, D. 2009. Letter to Illinois Environmental Protection Agency, Subject: Lowermost underground source of drinking water (USDW), Archer Daniels Midland Compnay—UIC Permit UIC-012-ADM, dated September 29, 2009.

A. Characteristics of the aquifer immediately overlying the confining zone

<u>1. Elevation at top of aquifer, include source</u>

The first aquifer which contains salt water at the proposed location overlying the Eau Claire Formation (the primary seal for the Mt. Simon Sandstone) is the Ironton-Galesville Formation (Figure 4a2). Based on the geophysical logging in CCS#1, the Ironton-Galesville was found at depths of 4,928 to 5,047 feet (119 feet thick).

<u>2. Potentiometric surface, include source</u>

No potentiometric data were collected during drilling of CCS#1 for the Ironton-Galesville. Thus, this section can not be updated from the Feasibility Report.

<u>3. Total Dissolved Solids, include source</u>

No water quality data were collected during drilling of CCS#1 for the Ironton-Galesville. Thus, this section can not be updated from the Feasibility Report.

<u>4. Lithology, include source</u>

No lithologic data were collected during drilling of CCS#1 for the Ironton-Galesville. Thus, this section can not be updated from the Feasibility Report.

<u>5. Aquifer thickness</u>

Based on the geophysical logging in CCS#1, the Ironton-Galesville was found to be 119 feet thick.

<u>6. Specific gravity, include source</u>

No water quality data were collected during drilling of CCS#1 for the Ironton-Galesville. Thus, this section can not be updated from the Feasibility Report.

B. Underground Sources of Drinking Water (USDW)

1. Maps and cross sections required by 730.114(a)(4) or 730.134(a)(4)

See the Feasibility Report for current maps and cross-sections of USDW. However, significant new data regarding the lowermost USDW was presented in a letter from Dean Frommelt of ADM to Illinois EPA, dated September 29, 2009.

2. Lowest depth of USDW

Overlying sources of groundwater which meet the definition of underground sources of drinking water (USDW) include three units from shallowest to deepest—Quaternary sand and gravel, Pennsylvanian bedrock, and the St. Peter Sandstone. Field investigations to determine the lowermost USDW at this site were discussed in a letter from Dean Frommelt of ADM to Illinois EPA, dated September 29, 2009.

Summarizing the information in this letter, water sampling showed that the water in the St. Peter Sandstone had a total dissolved solids (TDS) concentration of 4,540 mg/L, which is below the USDW limit of 10,000 mg/L TDS. In addition, the water quality in the Pennsylvanian bedrock transitions from fresh water (TDS < 10,000 mg/L) to brine (TDS > 10,000 mg/L) with depth. Currently, groundwater in the Pennsylvanian bedrock below 275 feet is considered to be a brine. Additional monitoring wells will be installed in 2010 to help refine the boundary between the fresh water and brine in the Pennsylvanian bedrock.

3. Elevation of potentiometric surface of lowest USDW referenced to mean sea level

See the Feasibility Report for a discussion regarding the potentiometric surface of the lowermost USDW.

4. Distance to nearest water supply well

See the Feasibility Report for a discussion regarding data on the nearest water supply well.

5. Distance to nearest downgradient water supply well

See the Feasibility Report for a discussion regarding data on the nearest water supply well.

VIII. Minerals and Hydrocarbons

See the Feasibility Report for a description of Mineral and Hydrocarbon resources in the area.

Figure 4a1: A north-south trending cross section across the Hinton #7, CCS#1, Harrison #1, and Weaber-Horn #1 (see A-A' in Figure CCS1_hinton_xsd_Mehnert.pdf)

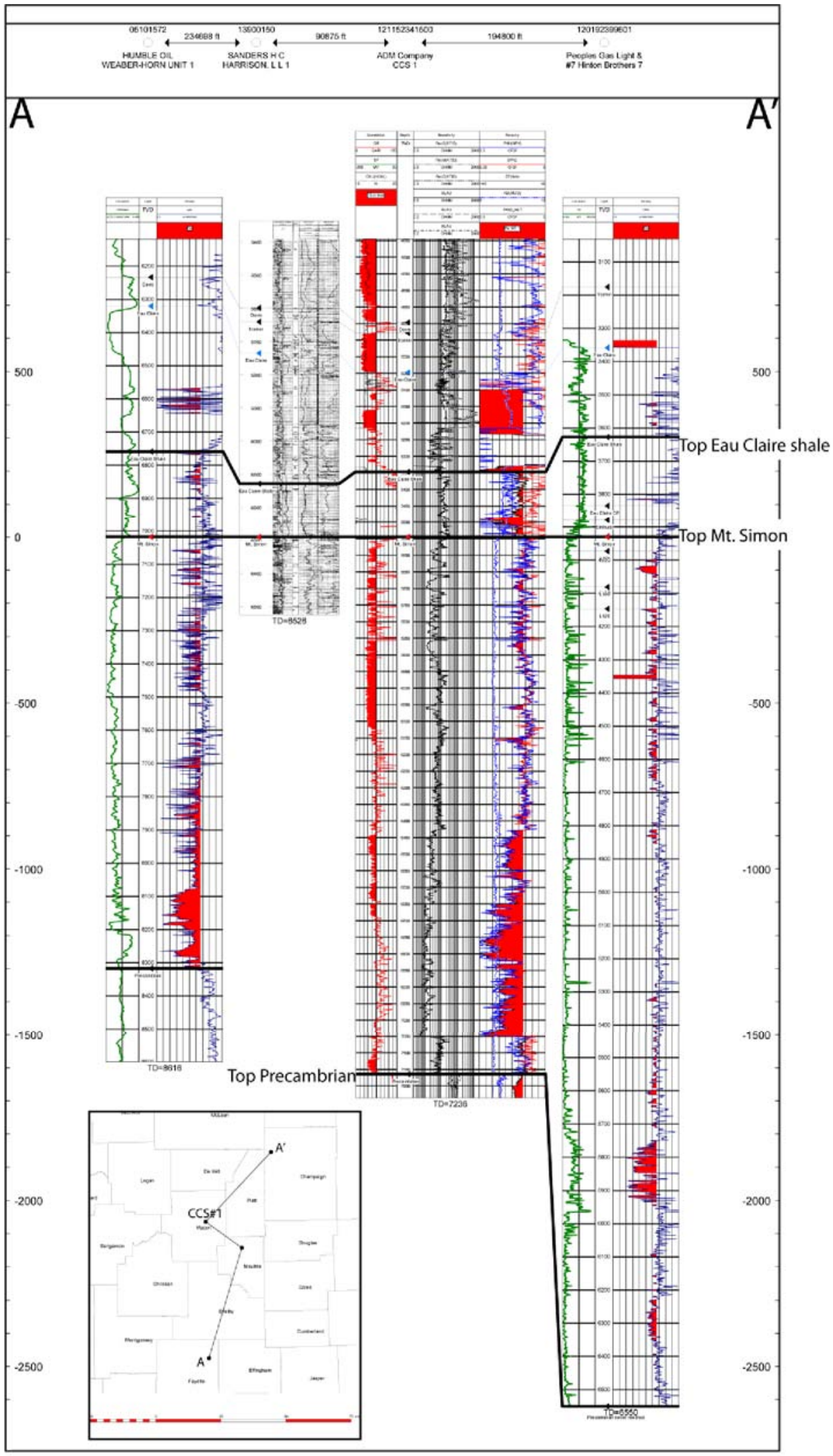


Figure 4a2 [use Figure 6 from Feas. Report]: Stratigraphic column of Ordovician through Precambrian rocks in northern Illinois (Kolata, 2005). Arrows point to the formations discussed in this UIC permit application. Dr., Darriwillian; Dol, dolomite; Fm, formation; Ls, limestone; MAYS., Maysvillian; Mbr, Member; Sh, shale; WH., Whiterockian; Mya, million years ago; Ss, sandstone; Silts, siltstone.

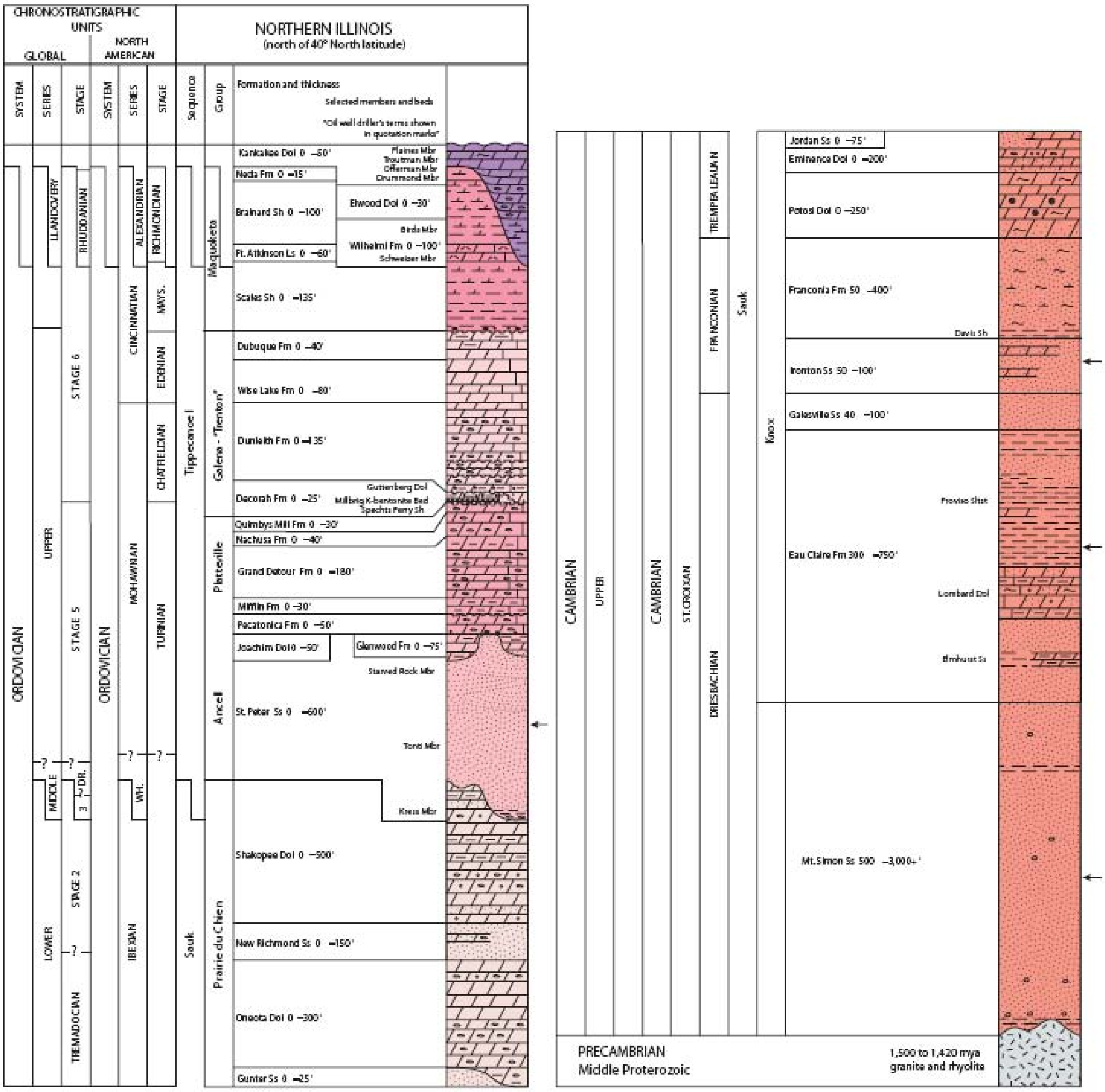


Figure 4a3: ADM CCS#1 step-rate test with fracture propagation pressure of 4966 psig estimated from the intersection of the two lines. The first line (2-6 bpm) represents radial flow of the Mt. Simon; the second line 7-8 bpm represents flow into the Mt. Simon after a fracture has propagated. The perforated interval was 7,025 to 7,050 feet during this step-rate test. (see Frailey_completionreport_0310.xls for original plot)

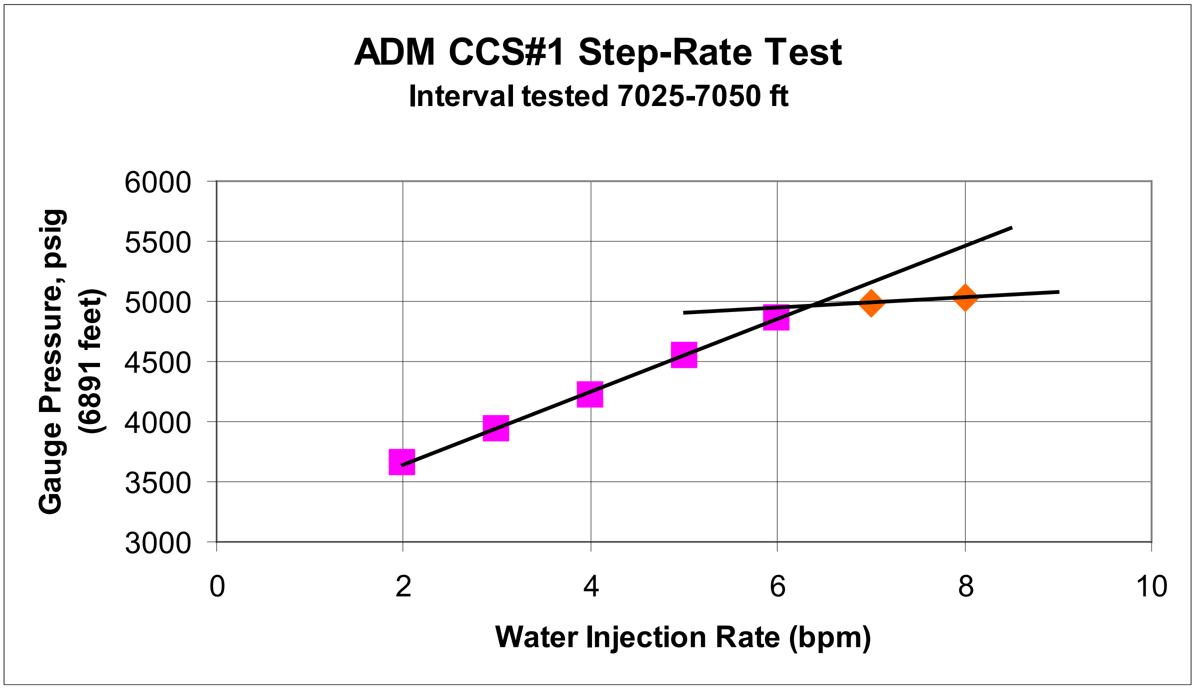


Figure 4a4: The bold line through the data is the unit slope, showing very good correlation between the two types of porosity data. For the porosity data from the rotary sidewall core plugs and the neutron-density crossplot porosity at the interval of the core plug, the porosity compares relatively well such that total and effective porosity are very similar. (see Frailey_completionreport_0310.xls for original plot)

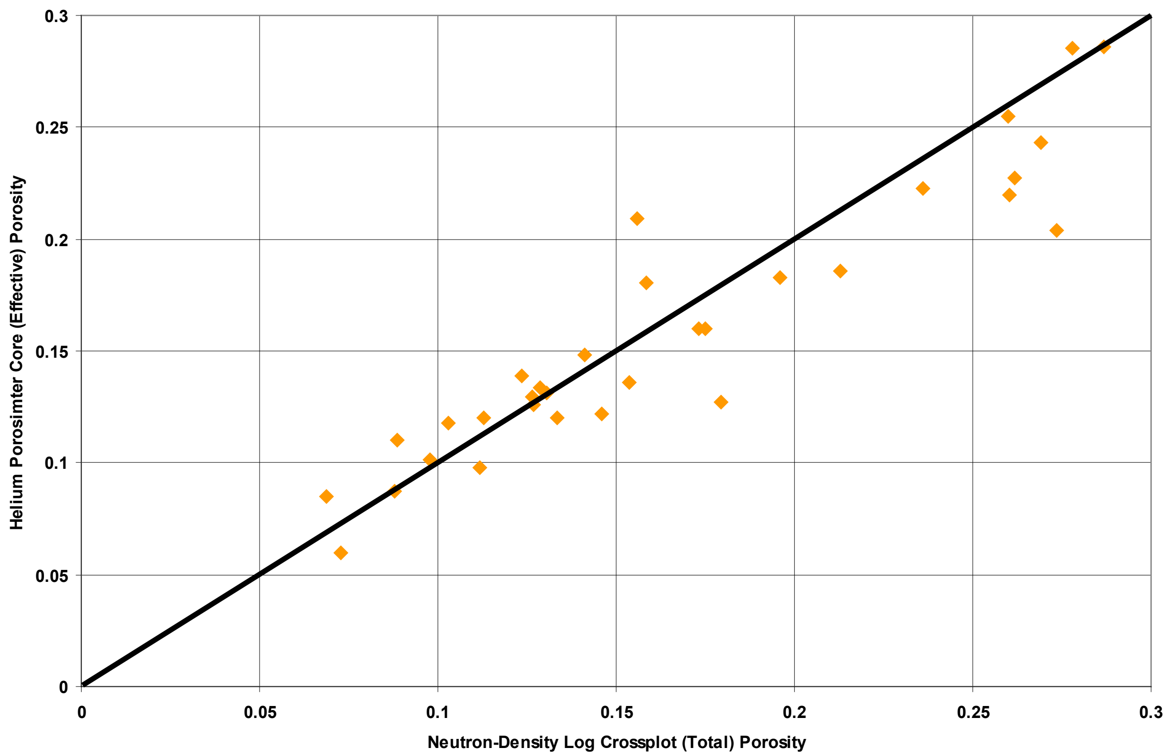


Figure 4a5. Crossplot of core permeability versus core porosity. Transforms were developed for three different grain sizes—fine grained, medium grained and coarse grained sandstone. (see frailey_completionreport_0310.xls for original plot)

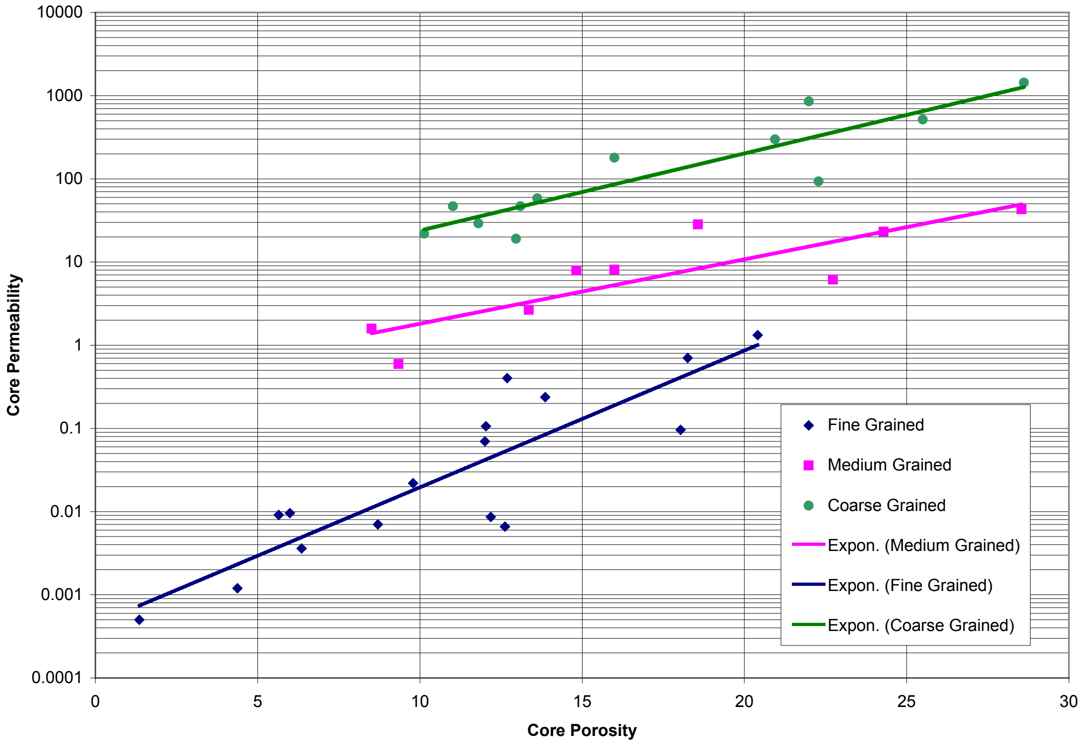


Figure 4a6: Qualitative derivative analyses of final pressure falloff test. Radial pressure response is indicated by a horizontal derivative trend. Two periods were measured during this test between 0.1 and 1 hours (PPNSTB) and 20 to 100 hours (STABIL). The first period corresponds to radial flow across the perforated interval; the second period corresponds to the larger thickness that would be between two much lower permeability sub-units e.g, the low perm granite wash at the base. The transition between the two radial responses (SPHERE) is a spherical flow period that is influenced by vertical permeability (or kv/kh). (The unit slope (UNIT SLP) indicating wellbore storage, identifies the end of wellbore storage influenced pressure data (ENDWBS) or pressure data that can be analyzed from reservoir properties.)

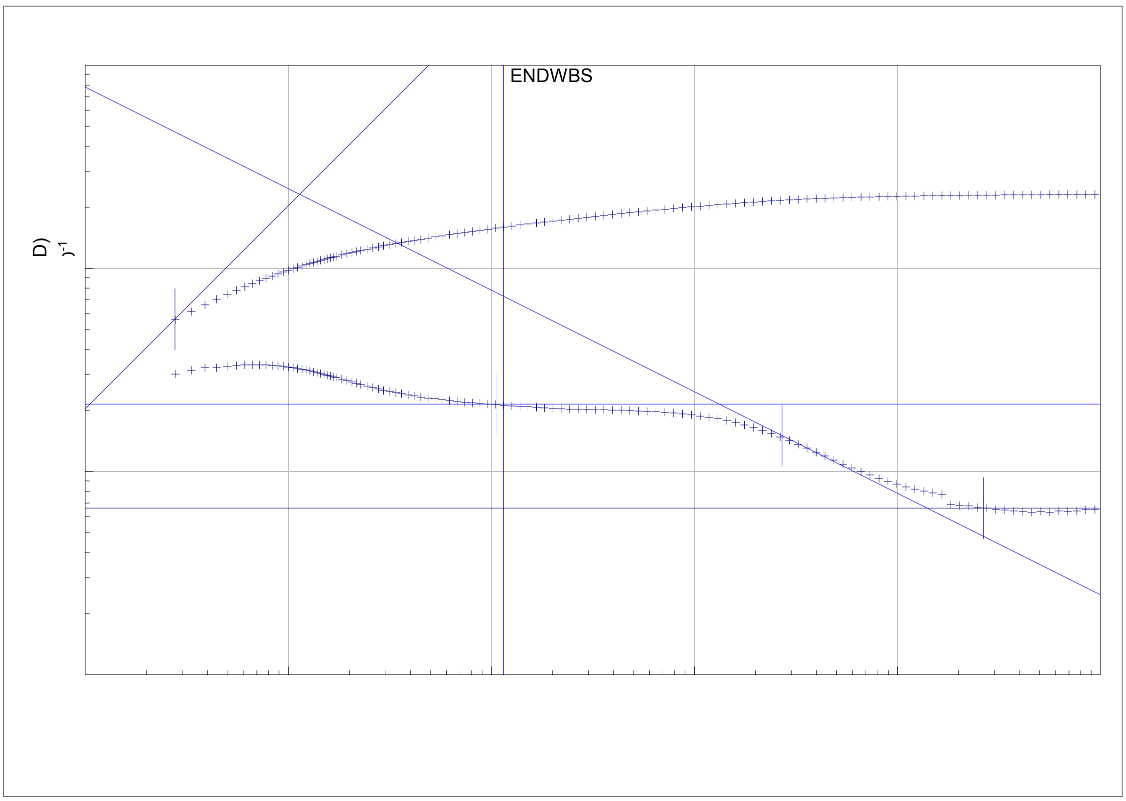


Figure 4a7: Overlay of pressure derivative of the three pressure falloff tests. The Green curve (upper pressure curve and bell shaped derivative) is the first falloff which had perforated interval of 7025-7050 ft MD. The pink (lower derivative curve) is the second falloff in the same perforated interval which had a modest acid treatment prior to the falloff. The dark blue (lower pressure curve middle derivative curve) was the third falloff tests for the perforated intervals of 6982-7012 and 7025-7050 ft MD and a second acid treatment over both perforated intervals. The difference between the green curve and the pink curve in the first 6 minutes is a result of the improvement to flow due to the acid treatment. The upper curves show the pressure difference and the lower curves show the derivative.

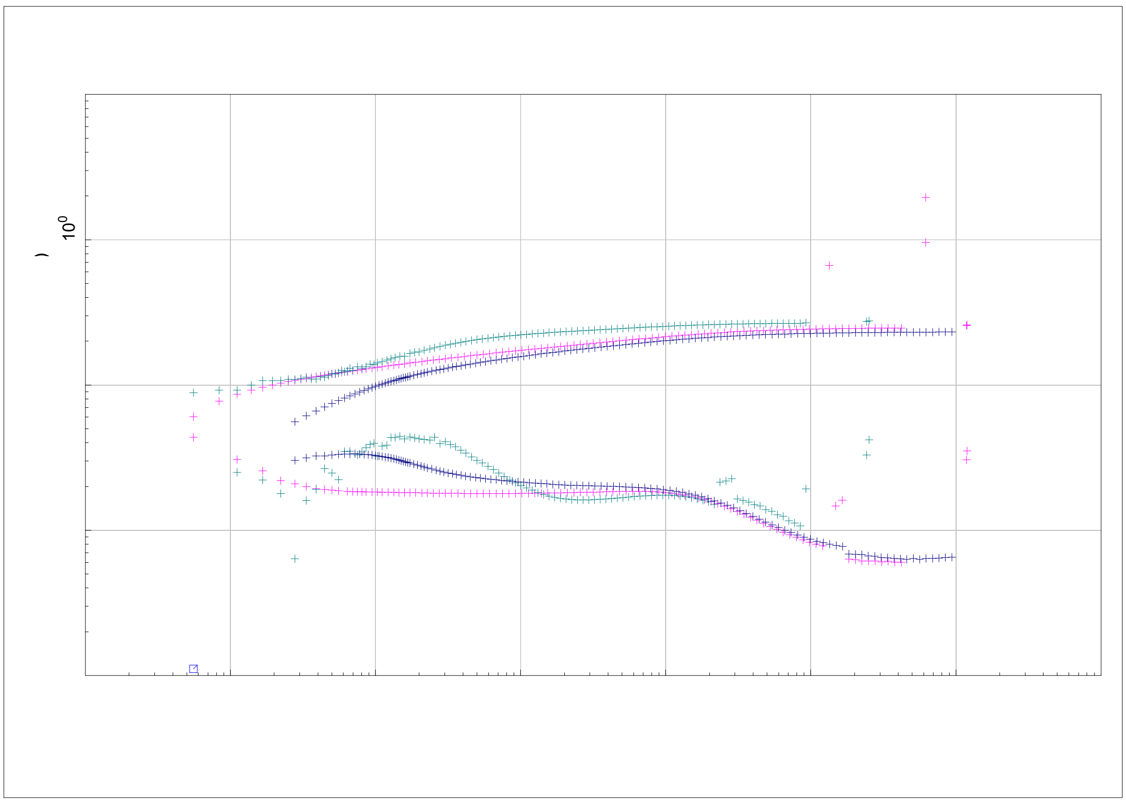
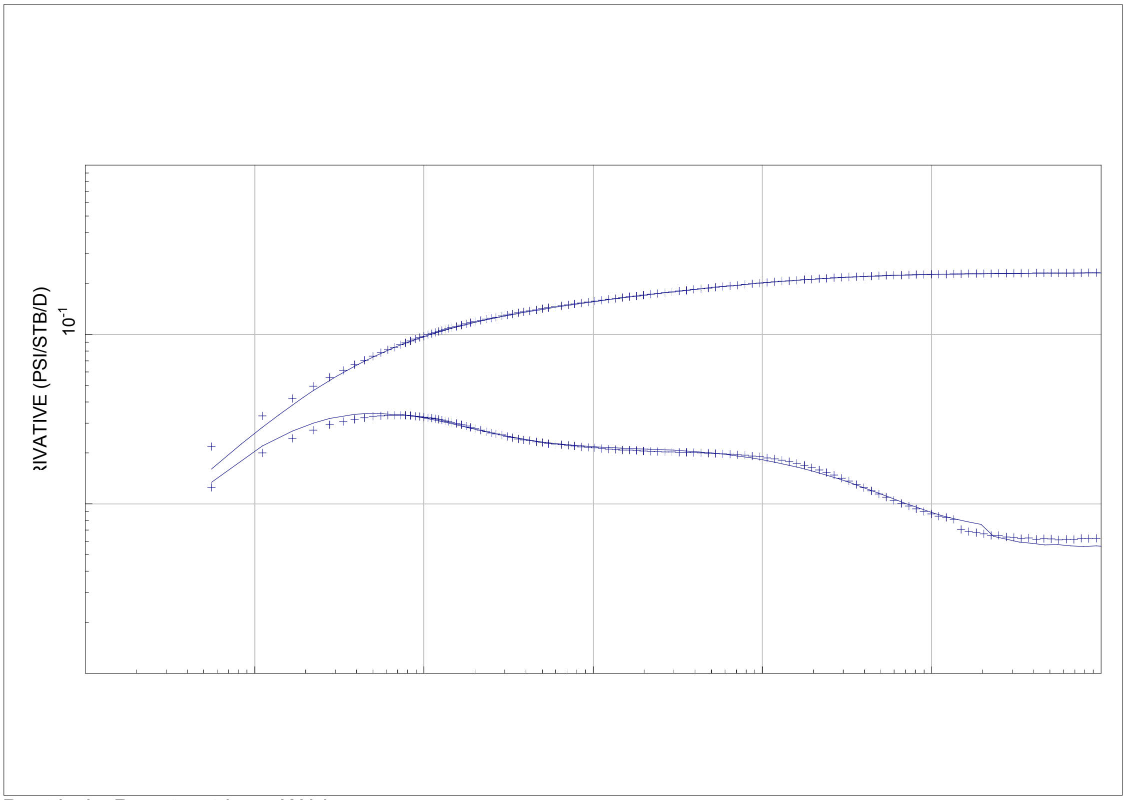
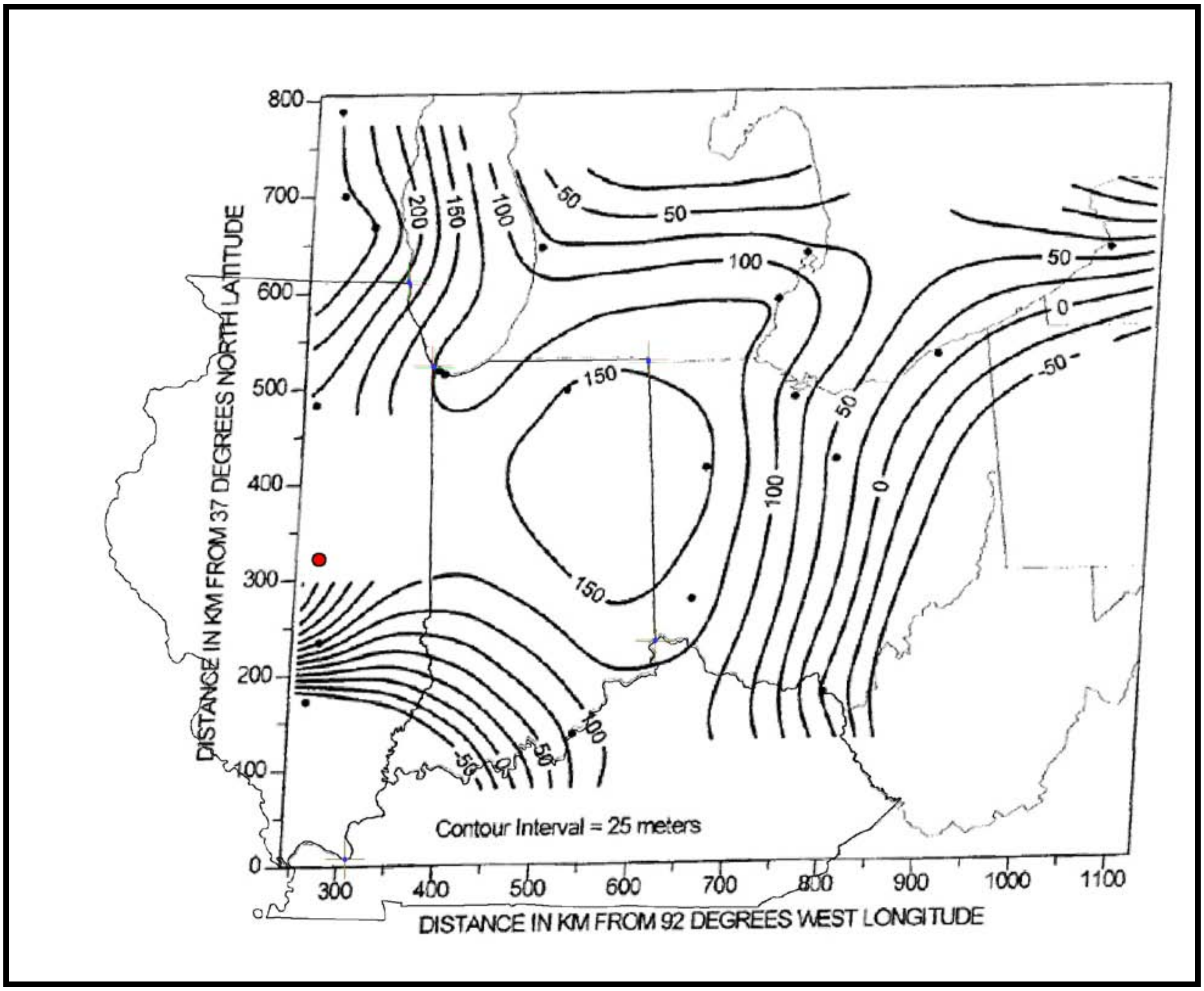


Figure 4a8: Nonlinear regression, or simulation history matching, of the of final pressure falloff test. Test data shown as + symbols and simulated data shown as line. The upper curve is the pressure difference and the lower curve is the derivative.




```
Partial Penetration Well
** Simulation Data **                          Type-Curve Model Static-Data
 well. storage   = 0.0011457 BBLS/PSI          Perf. Interval = 25.0 FEET
 Skin(mech.)     =  -0.85807
 permeability    =    184.58 MD                Static-Data and Constants
 Kv/Kh           =  0.013260                   Volume-Factor  = 1.000 vol/vol
 Eff. Thickness  =    75.000 FEET              Thickness      = 75.00 FEET
 Zp/Heff         =   0.83330                   Viscosity      = 1.300 CP
 Skin(Global)    =    10.301                   Total Compress = .1800E-04 1/PSI
 Perm-Thickness  =    13843. MD-FEET           Rate           = -6100. STB/D
```

Figure 4a9. Potentiometric surface in the Mt. Simon Sandstone in Indiana, Ohio and surrounding states (modified from Gupta and Bair, 1997). The red dot shows the location of the ADM site in east-central Illinois. At the ADM site, the potentiometric surface was calculated to be 76 m above mean sea level.



Appendix XIII.B – Revised UIC Form 4d

7 UIC Form 4d, Area of Review

Last revised: 4/1/2010

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
UNDERGROUND INJECTION CONTROL PERMIT APPLICATION

FORM 4d - AREA OF REVIEW

USEPA I.D. NUMBER ILD984791459
IEPA I.D. NUMBER 1150155136
UIC Well Number CCS #1

I. Radius of the Area of Review

A fixed radius of 2.5 miles was selected for the area of review.

II. Method of Radius determination

A fixed radius of 2.5 miles was selected for the area of review.

III. Map with information required by Section 730.114(a)(2) or 730.134(a)(2)

See the Feasibility Report for a discussion regarding maps of wells within the area of review. As discussed in the Feasibility Report, a total of 1,034 wells are known to be drilled within the area of review. The deepest well is 2,500 feet. Sixty-five oil wells within the Area of Review have been drilled to the depth range of 2,100 to 2,500 feet.

IV. Description of Anticipated Injection Fluid Movement during the Life of the Project

VIP reservoir simulator from Landmark Graphics (http://www.halliburton.com/ps/Default.aspx?navid=226&pageid=888&prodid=MSE%3a%3a1055451807810981) was used to estimate the plume migration around the proposed site. The proposal requires a minimum injection volume of 1.0 million metric tonnes (Mt). The geologic model was based on the open-hole well logs and the core analyses of CCS#1, verified with the water pressure transient injection falloff test. The structure was based on interpretation of two, 2-D seismic survey lines acquired prior to drilling the well and discussed in the Feasibility Report

The geologic model included the entire Mt. Simon from the base of the Eau Claire to the top of the granite. The Mt. Simon was divided into 108 vertical layers, with each layer being 15 feet thick.

For the simulation, CO_2 was injected at 0.333 Mt per year for three years. The lowest part of the Mt. Simon was used for injection. CO_2 could move vertically into higher parts of the Mt. Simon but not via the wellbore. Following three years of injection, two years of shut-in were also simulated.

Several models of varying model cell size and perforation strategies were used. Based on model results, the plume radius is expected to be approximately 1,500 feet. Because the injection interval is low within the gross thickness of the Mt. Simon, CO_2 flows upward from the injection interval. The CO_2 saturation increases below relatively lower permeability subintervals within the Mt. Simon. After three years of continuous injection into the lower part of the Mt. Simon and two years of shut-in, the CO_2 never reaches the caprock at the end of injection.

V. Wells Within the Area of Review

A. Tabulation of well data required by 730.114(a)(3) or 730.134(a)(3)

See the Feasibility Report for a tabulation of wells located within the 2.5 mile area of review.

B. Number of wells within 2 ½ miles of injection well penetrating within 300 feet of the uppermost injection zone which are:

1. *Properly plugged and abandoned – N/A*
2. *Temporarily abandoned – N/A*
3. *Operating– N/A*
4. *Improperly sealed, completed or abandoned– N/A*

As discussed in the Feasibility Report, there are no known wells within the 2.5 mile area of review that penetrate deeper than 2,500 feet. The depth to the top of the injection zone (Mt. Simon Sandstone) is 5,545 feet. Therefore, there are no known wells that penetrate within 300 feet of the uppermost injection zone.

C. Plugging affidavits for all plugged wells

See the Feasibility Report for the plugging affidavit for one plugged well located within the 2.5 mile area of review.

D. Proposed corrective action for unplugged wells penetrating the injection zone

See the Feasibility Report for a discussion of wells that required corrective action.

Appendix XIII.C – Revised UIC Form 4g

10 UIC Form 4g, Plugging and Abandonment

Last Revised: 3/31/2010

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
UNDERGROUND INJECTION CONTROL PERMIT APPLICATION

FORM 4g - PLUGGING AND ABANDONMENT PROCEDURE

USEPA I.D. NUMBER ILD984791459
IEPA I.D. NUMBER 1150155136
UIC Well Number CCS #1

I. Description of Plugging Procedures, see instructions

The plugging and abandonment design reflects minimum requirements to sustain the integrity of the caprock to ensure CO_2 remains in the Mt. Simon. Any unforeseen changes necessary to plug and abandon this well will meet or exceed these requirements in terms of strength or CO_2 compatibility. Appendix E has the Engineering Technical Report signed and sealed by an Illinois Registered Professional Engineer.

A. Abandonment during construction

Removal of subsurface well features: There are three scenarios in which abandonment during well construction (or drilling) and completion while the wellbore is open or uncased: Drilling the Surface Hole (<300 ft MD), Drilling Intermediate Hole (<5,000 ft MD), and Drilling Long-String Hole (<7,500 ft MD).

During all three scenarios, the drill string (drill collars, drill pipe, and drill bit) is the most likely equipment in the hole. Every attempt will be made to recover all of this equipment prior to abandonment.

If drill pipe, drill collars and/or drill bit are not retrieved and must be abandoned in the wellbore, no unique plugging procedure is required and plugs will be placed as described in the UIC permit application (4g.I.C). The same procedure will be used in the scenario where any testing tool, such as a core barrel, drill stem test assembly, or non-radioactive well logging tool, cannot be retrieved or is abandoned in the well.

If a radioactive well log is lost in the hole (density and/neutron porosity), current Nuclear Regulatory Commission (NRC) regulations will be followed. A 300 foot, red cement plug will be placed immediately above the lost logging tool. An angled, kick-plate will be placed above this plug to divert any subsequent drilling that may coincidentally enter this wellbore. Current NRC regulations require that the surface casing remain extended above the ground surface with an informative ground plate welded to the pipe. The plate includes information about the well to identify what is in the hole.

Plug Placement Method: The method of placing the plugs is the **Balanced Plug** method. This is a basic plug spotting process that is generally considered more efficient and considered compliant with accepted industry practices.

B. Abandonment after injection

Removal of subsurface well features: Casing: All casing used in this well will be cemented to surface and will not be retrievable at abandonment after injection.

Tubing and Packer: After injection, the injection tubing and packer will be the only injection equipment in the cased hole. Every attempt will be made to remove the injection tubing and packer. If the packer cannot be released and removed from the cased hole, an electric line with tubing cutter will be used to cutoff the tubing above the single packer.

Plug Placement Method: The **Balanced Plug** placement method will be used. This is a basic plug spotting process that is generally considered more efficient and considered compliant with accepted industry practices.

C. Type and quantity of plugging materials, depth intervals

In addition to the proper volumes, placement of plugs on depths approved by the agency (the minimum requirements), all cement will be previously tested in the lab, a Schlumberger CemCADE will be performed using actual well information such as actual depth, temperature on bottom, hole conditions. During the plugging operations, both wet and dry samples will be collected for each plug spotted to ensure quality of the plug.

All casing will be cemented to surface and no casing will be retrieved. From the surface, at least 3 feet of all the casing strings will be cutoff well below the plow line and a blanking plate with the required permit information will be welded to the top of the cutoff casing.

D. Detailed plugging and abandonment procedures

Notifications, Permits, and Inspections (Prior to Workover or Rig Movement)

Notifications, Permits, and Inspections are the same for plug and abandonment during construction and post-injection.

1. Notify Illinois EPA 48 hours prior to commencing operations. Insure proper notifications have been given to all regulatory agencies for rig move.
2. Make sure all permits to P&A have been duly executed by all local, State & Federal agencies and ADM have written permission to proceed with planned ultimate P&A procedure.
3. Ensure in advance that a pre-site inspection has been performed and the rig company has visited the site and is capable of transporting rig, tanks & ancillary equipment to perform P&A operations. Notify all key third parties of expected work scope, and ensure third party contracts for work are in place prior to move in.

4. Have copies of all government permits prior to initiating operations and maintain on location at all times. Check to see if conditions of approval have been met.

5. Make sure partners (U.S. DOE, IEPA and ADM) approvals have been obtained, as applicable.

6. Make sure all necessary forms for Schlumberger paperwork are on the rig, i.e., NPDES, safety meetings, trip sheets, etc.

Table 1: Plugging & Abandonment Contact List

Name	**Department/Pos**	**Office**	**Fax**	**Mobile**	**Home**
Paul Hughes, Jr., P.E.	Schlumberger-Operations	281-340-8658	281-285-0165	832-715-9060	281-781-8545
Robert J. Finley	ISGS Project Management	217-244-8389	217-333-2830	217-649-1744	217-384-6841
Tom Stone	ADM Project Engineer	217-424-5897			
Mark Carroll	ADM Environmental Coordinator	217-451-2720			
Kevin Lesko	Illinois Environmental Protection Agency	217-524-3271	217-524-3291		
	Federal Regulatory				

Volume Calculations

Volumes will be calculated for specific abandonment wellbore environment based on desired plug diameter and length required. Volume calculations are the same for plug and abandonment during construction and post-injection.

1. Choose the following:
    a. Length of the cement plug desired.
    b. Desired setting depth of base of plug.
    c. Amount of spacer to be pumped ahead of the slurry.

2. Determine the following:
    a. Number of sacks of cement required.
    b. Volume of spacer to be pumped behind the slurry to balance the plug.

c. Plug length before the pipe is withdrawn.
d. Length of mud freefall in drill pipe.
e. Displacement volume required to spot the plug.

3. See generic calculations in Figure 51 and have Schlumberger cementer and wellsite supervisor both review calculations prior to spotting any plug.

Note: For each cementing operation the Schlumberger cementer and the wellsite supervisor will verify via the cementing handbook or iHandbook all calculations and have the Project Manager approve the manner and procedure for said cementing operations. Any amendments to the plugging program will require an exemption approved in writing from the Project Manager.

Plugging and Abandonment Procedure for "During Construction" Scenario:

<u>Pumping the Cement Job (Figure 52)</u>

1. Trip in Hole (TIH) to the desired depth (drill pipe tags the base of the desired plug depth).
2. Shut down circulating trip tank on wellbore.
3. Break circulation and condition mud as required. Circulate at least until the pit levels stabilize.
4. Mix and pump cement and spacers.
5. Displace with the predetermined mud volume.
6. Shut down cementing unit and allow mud to freefall.
7. Near the end of the freefall, begin pulling out. Check to verify if we are pulling dry or wet.

<u>Pulling Out of the Plug (Figure 52)</u>

8. Resume circulating trip tank on the wellbore. Slowly pull the drillstring out of the plug and continue trip out of hole (TOH) until 2-3 stands above the top of the plug. Slowly pump 5-10 bbls to clear the drill pipe. Run circulating trip tanks continuously.

9. Do not attempt to reverse circulate because of potential contamination of the cement plug and to avoid over-pressuring the wellbore annulus. TOH.

10. Waiting on cement (WOC) minimum 12 hours, make up bottom hole assembly (BHA) and TIH to tag plug and record same. If tag will hold 5-10K lbs weight, pull up, circulate 1-2 stands above and continue with next balanced plug (either in open hole or inside casing) to properly comply with all local, state and federal regulations governing P&A operations (Table in Form 4g.I.C).

11. After spotting of all plugs, pull out of hole (POOH) laying down all drill pipe and drill collars, break out BHA

12. Finish cutting off below plow line (or per local, state or regulatory guidelines) all casing, dump 2-5 sacks of G cement in surface hole below plow line and weld plate on top of casing stub. Place marker as required by agencies.

13. After rig is released, commence with restoring site to as original condition as possible or per local, state or federal guidelines.

14. Complete plugging forms and send in with charts and all lab information to all state, local or federal agencies, as is required.

Plugging and Abandonment Procedure for "After Injection" Scenario:

1. Mobilize workover (WO) or Plugging Rig Equipment. Give IEPA and DNR 48 hours notice before commencing operations.

2. Move in rig to ADM CCS#1 location. Notify the Project Coordinator before moving rig. Ensure all overhead restrictions (telephone, power lines, etc) have been adequately previewed and managed prior to move in and rig up (MI & RU). All CO_2 pipelines will be marked and noted to WO rig supervisor prior to moving in (MI) rig. Move rig onto location per operational procedures.

3. Conduct a safety meeting for the entire crew prior to operations, record date and time of all safety meetings and maintain records on location for review.

4. Make daily "Project Inspection" walks around the rig. Immediately correct deficiencies and report deficiencies during the regulatory discussion during morning meetings/calls. Maintain International Association of Drilling Contractors (IADC) or plugging reports daily at the WO rig log book or doghouse.

5. MI rig package and finish rigging up hoses, hydraulic lines, etc.

6. Open up all valves on the vertical run of the tree. Check pressures.

7. Rig up pump and line and test same to 2,500 psi. Fill casing with kill weight brine (9.5 ppg). Bleeding off occasionally may be necessary to remove all air from the system. Keep track and record volume of fluid to fill annulus (Hole should be full). If there is pressure remaining on tubing rig to pump down tubing and inject two tubing volumes of kill weight brine. Monitor tubing and casing pressure for 1 hour. If both casing and tubing are dead then nipple up blowout preventers (NU BOP's). Monitor casing and tubing pressures.

8. If needed, if well is not dead nor pressure cannot be bled off of tubing, rig up (RU) slickline (SL) and set X-lock plug in X nipple located in X-Plug in tailpipe below packer. Circulate well with kill weight brine. Ensure well is dead. ND tree. NU BOP's and function test same. BOP's should have 4 ½"single pipe rams on top and blind rams in the bottom ram for 4 ½" Test BOP's as per local, state or federal provisions or utilize higher standard, 30 CFR250.616. Test pipe rams and blind rams to 250 psi low, 3,000 psi high. Test annular preventer to 250 psi low and 3,000 psi high. Test all TIW's, IBOP's choke and kill lines, choke manifold, etc. to 250 psi low and 3,000 psi high. **NOTE: Make sure casing valve is open during all BOP tests.** After testing BOPs pick up 4 ½ tubing string and unlatch seal assembly from seal bore. Rig slick line and lubricator back to well and remove X- plug from well. Rig to pump via lubricator and keep well dead.

9. RU 4 ½" rig hydraulic tubing tongs for handling of production tubing. Pick back up on tubing string and pull seal assembly from seal bore. Pull hanger to floor and remove same. Circulate bottoms up with packer fluid.

10. POOH with tubing laying down same. **NOTE: Ensure well does not flow due to CO_2 "back flow"! Well condition is to be over-balanced at all times with at least 2 well control barriers in place at all times.**

    Contingency: If unable to pull seal assembly RU electric line and make cut on tubing string just above packer. Note: Cut must be made above packer at least 5-10 ft MD. Several different sizes of cutters and pipe recovery tools should be on location due to possible tight spots in tubing.

11. If successful pulling seal assembly then pick up 3 ½ or 4 ½ inch workstring and TIH with Quantum packer retrieving tools. If tubing was cut in previous step then skip this step. Latch onto Quantum packer and pull out of hole laying down same. If unable to pull Quantum pull work string out of hole and proceed to next step. Assuming tubing can be pulled with packer with no issues, run CBL or USIT to determine that there is no leakage around the wellbore above the caprock. If leakage is noted prepare cement remediation plan and execute during plugging operations. Set 9 5/8 inch cement retainer on wireline just in Eau Claire above the Mt Simon Formation (approximately 5250 feet). Trip into hole with work string and sting into cement retainer. Test backside to 750 psi for 30 minutes on chart. A successful test should have less than 10% bleed off over the 30 minute period. This will be considered a successful casing test. Establish injection with packer kill fluid at 0.5, 1, and 2 BPM not to exceed 2,000 psi injection pressure. Sting out of retainer.

12. With pipe stung out of retainer, Mix and pump 300 (63 bbls) sacks of Class "H" cement mixed at 15.6 ppg plus fluid loss additive as proposed by cementing company and actual downhole conditions (temperature, BHP, etc). Obtain fluid loss of less than 100 cc/30 min. Follow that with 500 (105 bbls) sacks Class H cement mixed at 15.6 ppg with dispersant. Circulate to within 5 bbls of end of work/tubing string, sting into retainer and finish mixing cement. Displace tubing and squeeze away 30 bbls of cement into the open perforations.. Note: Do not squeeze at higher pressures than 2,000 psi. Sting out of retainer and reverse out a minimum of 2 pipe volumes. **Note: Leave cement on top of retainer.**

13. POOH racking back work string. Shut down for 12 hours Go in hole (GIH) open ended. Tag up on cement on top of retainer and note same.

14. Circ well and ensure well is in balance. Place tubing just above cement top from previous day. Mix and spot 500 ft balanced plug in 9 5/8 inch casing (approximately 175 sacks Class A or H). Pull out of plug and reverse circulate tubing. Repeat this operation until a total of 10 plugs have been set. If plugs are well balanced then the reverse circulation step can be omitted until after each third plug. Lay down work string while pulling from well. If rig is working daylights only then pull 10 stands and rack back in derrick and reverse tubing before shutting down for night. The following morning trip back in hole and tag plug and continue. After ten plugs have been set pull tubing from well and shut in for 12 hours. Trip in hole with tubing and tag cement top. Calculate volume for final plug. Pull tubing back out of well. Nipple down BOPs and cut all casing strings below plow line (min 3 feet below

ground level or per local policies/standards and ADM requirements). Trip in well and set final cement plug. Total of approximately 2660 sacks total cement used in all plugs. Lay down all work string, etc. Rig down all equipment and move out. Clean cellar to where a plate can be welded with well name onto lowest casing string at 3 ft.

15. File all plugging forms to local state, federal and other agencies as required.

Note: utilize all local, state or federal rules relative to P&A or at least 33% plus actual volumes or as approved previously by Illinois state agency or Federal agency.

E. Cost estimate for plugging and abandonment worst case scenario

Itemized P&A Costs	During Construction	Post Construction*
a. Casing Evaluation:	N/A	$50,000
Mobilize equipment and crews from nearest district. Run multi-finger caliper for detailed inspection of the inner surface of the casing. Run Isolation Scanner for final condition of outer surface of casing and cement condition. Compare to baseline logs run before injection started.		
b. Evaluation of any problems discovered by the casing evaluation:	N/A	$20,000
Downhole video camera to get visual images of the questionable inner surfaces of the casing.		
c. Cost for repairing problems and cleanup of any groundwater or soil contamination:	N/A	$40,000
CO_2 as a vapor in soil would not result in contamination like a liquid. A formal "cleanup" may not be required, and the CO_2 would dissipate into the atmosphere. CO_2 into groundwater would like be the same as that in oil. For a period of time, the shallow groundwater may have a low concentration of CO_2 similar to a "flat" soft drink. With time the CO_2 will dissipate into the unsaturated soil and dissipate.		
d. Cost for cementing or other materials used to plug the well:	$37,000	$78,000
e. Cost for labor, engineering, rig time, equipment and consultants:	$157,000	$157,000

f. Cost for decontamination of equipment:	N/A	N/A
g. Cost for disposal of any equipment:	N/A	$2,000
Tubing would be sold as scrap metal and worst case cost would be trucking services only.		
h. Estimated sales tax:	$2,000	$2,000
Our review shows there is no state sales tax for this kind of work.		
i. Miscellaneous and minor contingencies (20%):	$10,000	$10,000
j. Total	$206,000	$359,000

* Post Construction cost is for 1/1/08; if the well was abandoned 30 years from now, assuming 3% annual inflation the worst case P&A would be 2.43 times greater or $873,370.

Figure 51: Plugging Volume Calculations

VOLUME CALCULATIONS

1. CAPACITIES

Determine the following capacities:

Annular capacity between drillpipe and hole (V_{ANN})	ft^3/ft and ft/bbl
Hole or casing capacity (V_{CAPOH})	ft^3/ft
Drillpipe or tubing capacity (V_{CAPDP})	ft^3/ft and bbl/ft

2. NUMBER OF SACKS OF CEMENT

Determine the number of sacks of cement required for a given length of plug (sx):

N_{SX} = L_{PLUG} X V_{CAPOH} / slurry yield

Where:

N_{SX} = number of sacks of cement, sx

L_{PLUG} = length of cement plug, ft

V_{CAPOH} = capacity of open hole or casing, ft^3/ft

Slurry yield = cement yield, ft^3/sk

3. SPACER VOLUME BEHIND SLURRY

Determine the spacer volume to be pumped behind the slurry to balance the plug (bbls):

$V_{TAILSPACER}$ = V_{ANN} X $V_{LEADSPCR}$ X V_{CAPDP}

Where:

$V_{TAILSPACER}$ = spacer volume to be pumped behind the slurry to balance the plug, bbls

V_{ANN} = annular capacity, ft/bbl

$V_{LEADSPCR}$ = spacer volume to be pumped ahead of cement plug, bbls

V_{CAPDP} = drill pipe capacity, bbl/ft

Figure 51: Plugging Volume Calculations, contd.

VOLUME CALCULATIONS, CONTINUED

4. PLUG LENGTH

Determine the plug length (ft) before the drill pipe is withdrawn (ft):

L_{PLUG} = (N_{SX} X slurry yield) / (V_{ANN} + V_{CAPDP})

Where:

L_{PLUG} = length of cement plug before the DP is withdrawn, ft

N_{SX} = number of sacks of cement, sx

Slurry yield = cement yield, ft^3/sk

V_{ANN} = annular capacity, ft^3/ft

V_{CAPDP} = drill pipe capacity, ft^3/ft

5. LENGTH OF FREEFALL IN DRILL PIPE

Determine the length of mud free fall in drill pipe (ft):

L_{FF} = TD (1 – MW)

Where:

L_{FF} = length of free fall inside the drill pipe, ft

TD = depth, ft

MW = mud density, pPG

6. DISPLACEMENT VOLUME

Determine displacement volume required to spot the plug (bbl):

V_{DISP} = [(L_{DP} – L_{PLUG} – L_{FF}) X V_{CAPDP}] – $V_{TAILSPCR}$

Where:

V_{DISP} = displacement volume required to spot cement plug, bbls

L_{DP} = length of drill pipe, ft

L_{PLUG} = length of cement plug, ft

L_{FF} = length of freefall, ft

V_{CAPDP} = drill pipe capacity, bbl/ft

$V_{TAILSPCR}$ **= spacer volume to be pumped behind the slurry to balance the plug, bbls**

Figure 52: Schematic of pumping the cement job using the balanced plug method.
The mottled grey is cement, the white is spacer, and the brown is mud. In the first graphic, the first spacer has already been pumped, and they are pumping in the cement. In the 2nd graphic, they have displaced most of the cement (don't want to contaminate the cement, so leave a little in pipe at this stage), pulled the end of the pipe up into the space, and are displacing the end of the cement and putting more spacer fluid in between the mud and the cement. In the 3rd graphic, they are circulating mud to clean the pipe and casing of any cement before it sets.